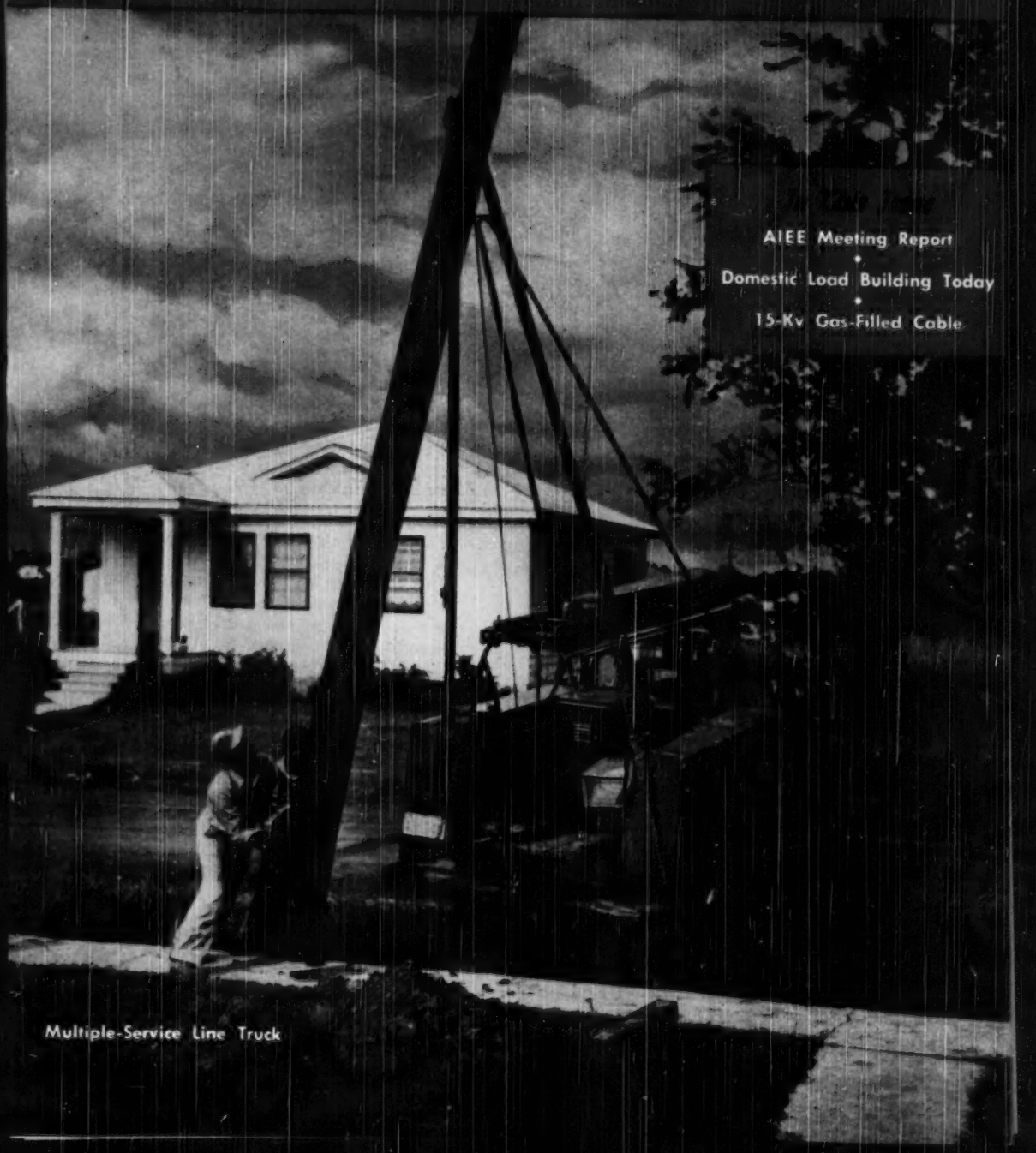
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

FEBRUARY 15, 1950 • OUR 75th YEAR



AIEE Meeting Report

•

Domestic Load Building Today

•

15-Kv Gas-Filled Cable

Multiple-Service Line Truck

THIS MAN WORKS *Faster Better Safer*

Because the

Murray CROWS'NEST

affords FIRM, SURE FOOTING
PROPER HEIGHT
WIDE REACH
COMPLETE ROTATION

plus—

The Unmatched *Safety* of Non-Metallic Construction and Semi-Automatic Operation

Steadier . . . stronger . . . safer — that's the Murray demountable Crows'nest, the world's most versatile aerial maintenance ladder. Use it for servicing street lights, inspecting overhead lines, trimming trees, connecting service entrance cables, restoring service when lines go down. Easily operated by only one man, yet strong enough to support ten . . . steady as the truck chassis itself . . . with the inherent safety around high voltage wires that only wood construction achieves!

Murray Crows'nest aerial ladders are available in working heights of 26, 28, 30, 32, 35, 40, 45 and 50 feet. (Ladder at left is the 40 foot size.) They can be mounted on any ¾ ton (or larger) truck weighing 2700 pounds or more. To free the truck for other work, the entire assembly is demounted by removing a single bolt. Write for descriptive bulletin.

Murray MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

Check Murray on your requirements for

Cable Racks — Cable Protectors
Manhole Wall Inserts
Aluminum Meter Sockets
Padlock Seals — Disconnect Plugs
Perforated Strapping — Cable Grips

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS'NEST AERIAL LADDERS

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

VOL. 133 FEBRUARY 13, 1950 NO. 7

EDITORIAL 61

NEWS . . The Electrical Week Washington Comment Technical Notes 63

WHY WE CHOSE 15-KV GAS-FILLED CABLE FOR CHEMICAL PLANT FEEDERS, by R. E. Philbeck 73
Gas filled cables insure continuous service in plant where current failure could cost up to $100,000

TODAY'S LIGHTNING KNOWLEDGE CAN IMPROVE DISTRIBUTION LINE DESIGN, by John P. Barron 76
Distribution today—Better performance will follow application of present knowledge

INDUSTRY TECHNIQUES ADVANCED IN AIEE SESSIONS 80
Report of technical discussions shows progressive trend of engineering thought

GROUNDED SHEATH AND ARMOR SERVE AS THIRD CONDUCTOR FOR SUBMARINE CIRCUIT, by F. O. Wallaston 86
Gives lowest cost per kva, allows for later load growth by addition of third conductor

TELL IT ALL AND TELL IT EASY, by George Kerr 88
If people were told more about how a power company works, public understanding would be improved

RESIDENTIAL LOAD BUILDING—THE PICTURE TODAY, by Robert E. Ginna 91
As yet, not enough salesmen, not enough organization, for the load building job

HOW TO 94
Service-Line Truck Has Many Uses Resistor-Shunt Checks Field-Temperature Recorder
Standard Relays Replace Mechanical Alternator Manhole Cleaning Time Reduced 75%

ENGINEERING REFERENCE SHEETS 104
Determine Voltage Drop and Conduit Size For One 3-Conductor, 600-v, LC Cable Transformer Polarity

LOAD BUILDING 116
Infrared Cuts Drying Time on Painted Posters Toledo Edison Increases Commercial Cooking Sales
Flexible Display Lighting Self-Service Counter for Lamps Saves Customer Time

NEW EQUIPMENT	124	TECHNICAL LITERATURE	152
NEWS ABOUT PEOPLE	136	BOOKS	154
MANUFACTURERS AND MARKETS	146	LETTERS	157
NEW ELECTRICAL CONSTRUCTION	150	INDEX TO ADVERTISERS	162

COVER—Louisiana utility develops truck that can be used for service, trouble, light-construction and street light patrol duty

RALPH H FLYNN, *Publisher* FISCHER BLACK, *Editor* DANIEL T BRAYMER, *Managing Editor*

ARCHER E KNOWLTON *Senior Associate Editor* FRANCIS J KOVALCIK.....*Assistant Editor* EDWARD ALLEN.....*Midwestern Editor*
FRANK R INNES.....*Associate Editor* KENNETH K KOST.....*News Editor* EARL CARVER.....*Art Editor*
ROBERT C BLATT.....*Associate Editor* LOIS A STEWART.....*Assistant News Editor* BERLON C COOPER.....*Lighting Consultant*
W B WHICHARD.....*Associate Editor* JOSEPH A ROBINSON.....*Pacific Coast Editor* GEORGE B BRYANT, JR. *Mgr Washington Bureau*
RUE M SHOOP.....*Assistant Editor* HOWARD S KNOWLTON..*New England Editor* RONALD D ROSS..*Washington Correspondent*

WORLD NEWS BUREAU, Russell F Anderson, *Editor*; London, Paris, Frankfurt, Moscow, Tokyo, Bombay, Melbourne, Rio de Janeiro, Buenos Aires
DOMESTIC NEWS BUREAUS, Atlanta, Chicago, Cleveland, Detroit, San Francisco, Houston. Correspondents in 43 principal cities
ECONOMICS DEPARTMENT, Dexter M Keezer, *Director*, William F Butler, Sanford S Parker, Robert P Ulin

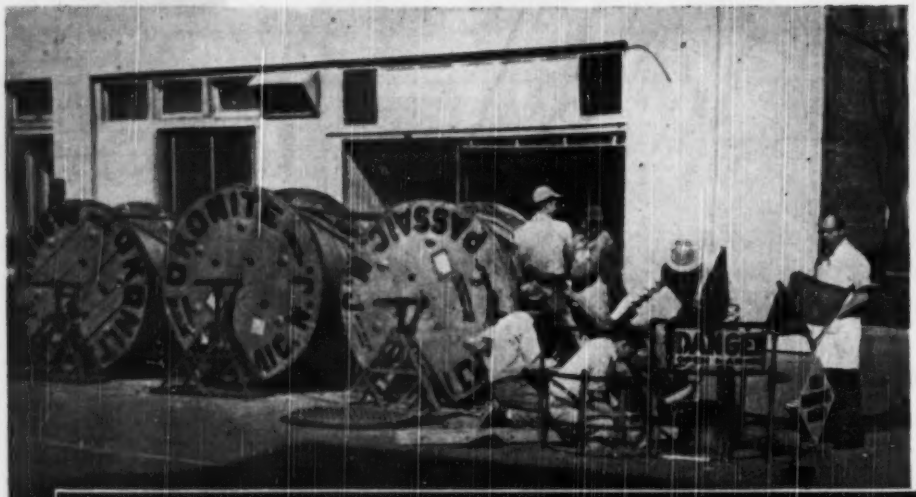
DISTRICT MANAGERS, E F Coffey, New York; N V Palmer, Boston; F P Coyle, Philadelphia;
C R Lippold, Cleveland; P S Griffin, Detroit; W H Meneilley, Chicago; J T Schaefer, St. Louis

ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; James H McGraw, Jr., President; Curtis W McGraw, Vice-President and Treasurer; Eugene Duffield, Senior Vice-President, Publications Division; Nelson Bond, Vice-President and Director of Advertising; J E Blackburn, Jr, Vice-President and Director of Circulation; Joseph A Gerardi, Secretary. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian reciept at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

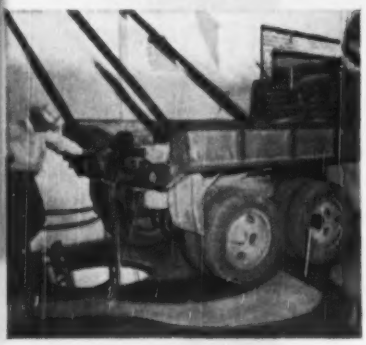
Copyright 1950, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

Cable address McGRAW-HILL, New York. Member ABP Member ABC

Sierra Pacific Power Co. installs new distribution system in Reno



BENEATH STREETS PAVED WITH SILVER and GOLD



Expensive street — economical cables. Famed Reno's fabulous Lincoln and Douglas Alleys are paved with gold and silver ores that assay as high as $450 a ton. But when the Sierra Pacific Power Company recently installed 7,000 feet of underground cable, their choice was dependable, economical Okolite-Okoprene.

7,000 ft. of "Time-proved" Okolite-Okoprene Cable carries the power for Reno's Fabulous "Lincoln and Douglas Alleys"

Silver and gold are intriguing choices for paving material. But down-to-earth, dollars and cents experience stands behind the Sierra Pacific Power Company's choice of Okolite insulation with Okoprene protective covering for the 7,000 ft. of underground cable recently installed in this famous section of Reno.

Applied by the exclusive Okonite strip method and simultaneously vulcanized in a continuous metal mold, the tough, durable Okoprene covering and long-lived, moisture-resistant, high-voltage Okolite insulation acquire a perfect, permanent bond. Their combined protective and insulating characteristics provide a lasting degree of oil and water-resistance, non-flammability, and resistance to mechanical damage unequalled in cables of this type. And Okonite's Semicon tape, next to the conductor, eliminates internal corona cutting.

Whatever your requirements, there's an Okonite cable designed to give you true economy through long-lived, trouble-free cable service. In these days of high installation and maintenance costs it's wise to look ahead . . . to remember that the best cable is your best policy. The Okonite Company, Passaic, New Jersey.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE SINCE 1878 *insulated wires and cables*

8021

HOW SAFE

CAN YOUR LINEMEN BE?

All-over Protection

Your linemen are no safer than their equipment makes them. For surer protection, provide them with Salisbury rubber line hose, insulator hoods, protective blankets . . . rubber coats, gloves, and sleeves. Graybar has distributed these and other Salisbury safety accessories for many years. Linemen trust them.

HOT-LINE TOOLS

Graybar offers Chance hot-line maintenance tools individually or in complete sets. They incorporate the latest developments in equipment for repairing energized lines. Metal fittings are lightweight, strong, heat-treated aluminum alloy. Poles are laminated spruce. We can provide you with specialized tools of various types for performing all hot-line jobs safely and efficiently.

First for First-aid

Linemen's first-aid kits must be weatherproof, dustproof, easy to handle, and complete in the supplies they might need. That's why the M.S.A. kits available from Graybar are favorites. In addition to 10-unit and 24-unit all-weather kits, Graybar distributes pocket-size M.S.A. first-aid packets.

NEAR YOU

There are stocks of some pole-line safety equipment at a Graybar warehouse near you. You can also get prompt delivery of many other pole-line items such as safety straps, hand tools, and specialized construction tools. Let your local Graybar Representative give you specific information about them. For special help on any problem "from the bottom of the hole to the top of the pole", talk with a Graybar Outside Construction Specialist. *Graybar Electric Company, Inc. Executive offices: Graybar Bldg., N. Y. 17, N. Y.*

4852

Everything for your pole lines
Via GraybaR

IN OVER 100 PRINCIPAL CITIES

When you think of Electric Heat think of Hoskins Chromel*

No one ever bought a kilowatt hour; of itself, it's not a saleable commodity. But millions of your customers have "put it on the line" for a smartly styled, spick-and-span, brand new electric range. With all the latest in time, temperature, and power controls. With deepwell cookers, pressure cookers, warming drawers. With stepless control of higher wattage units and many other "plus-value" features . . . all based entirely around the convenient extra use of your good services in the practical application of dependable electric heat.

And when you think of electric heat . . . as one of your major residential, commercial, and industrial load potentials . . . you'll do well to think of it in terms of HOSKINS CHROMEL. For Chromel, you know, is the *original* nickel-chromium resistance alloy that first made electrical heating practical. It's durable stuff . . . possesses close-to-constant "hot" resistance between 700° and 2000° F., delivers full-rated power throughout its long and useful life. Backed by over 40 years specialized research, manufacturing, and application experience. Used consistently and with confidence by every major heating appliance and device manufacturer . . . nearly all the smaller ones, too. Because, from a performance point-of-view, HOSKINS CHROMEL is largely responsible for today's widespread acceptance of every product in which it is used.

So if you're responsible for building your company's heating load . . . and if you're not already thoroughly familiar with HOSKINS CHROMEL . . . now's a good time to get acquainted. Our Catalog M1 is loaded with helpful technical information and application data . . . want a copy?

HOSKINS MANUFACTURING COMPANY

4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW YORK • CLEVELAND • CHICAGO

West Coast Representatives in Seattle, San Francisco, Los Angeles
In Canada: Walker Metal Products, Ltd., Walkerville, Ontario

**the original nickel-chromium resistance alloy that first made electrical heating practical*

Approved by UNDERWRITERS LABORATORIES
The men who USE them know the difference!
they like this—
BETTER DESIGN
If you have ever spliced wires and cables in real mean locations, you probably are a strong "booster" for Penn-Union Connectors - - -
Because you know how much easier they are to use in close quarters: Working up against a wall... squeezing into small boxes, to join short ends of stiff wire . . . reaching around pipes, and splicing wires in dark holes where you can hardly see.
LARGER SURFACES
for the wrenches make the Penn-Union connector more practical—you grip it from ANY angle, with ANY kind of wrench (box, socket or open-end). Developed by 20 years of constant improvement. Accurately made, with rigid engineering inspection. Reusable over and over. Can be furnished in Bronze or Aluminum.
Far More in use than any other
Sold by Leading Wholesalers
PENN-UNION ELECTRIC CORP.
ERIE, PA.
Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto
The COMPLETE Line of Conductor Fittings
PENN-UNION

Tirex Cables Can Take It!!

NAME YOUR HAZARDS; the hazards that time and again raise havoc with the portable cords and cables you depend upon for the efficient operation of vital electric equipment.

Water, snow and mud as pictured here; dragging over rough surfaces and pulling around sharp bends; runovers by heavy mobile equipment; grease, oil, chemicals, sunlight, heat and flame — a few, perhaps all of these cable enemies are writing "down time" into the performance records of your equipment.

You can beat the problem, simply, economically, by specifying Simplex-TIREX Cords and Cables when you next order. The TIREX line is performance proved — proved in the field under the most severe conditions during more than a quarter-century of service to all industries. It includes cords and cables that meet the requirements of all portable electric apparatus. All are jacketed with cured-in-lead Selenium Neoprene Armor, the toughest, most-reliable protection available for portable cords and cables.

If you would like complete information write us today for a TIREX Catalog, specifying the voltage range you are principally interested in.

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

Select Allis-Chalmers Type H Starters

TO CONTROL 2300 & 4600 VOLT MOTORS!

GUIDE TO ALLIS-CHALMERS CONTROL

Construction, Application, Specifications

FOR CONTROL OF MOTORS up to 700 hp at 2300 volts — 1250 hp at 4160 or 4600 volts, use Allis-Chalmers Type *H* starters on pumps, blowers, compressors, motor-generators, and all types of industrial drive installations.

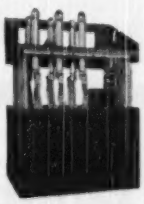
Type *H* Starters combine the best contactor for your needs with current limiting fuses to give you dependable operation plus complete protection! Even if the contactor closes on a short circuit; motors, personnel and machinery are safeguarded . . . protected by current limiting fuses.

The Type *H* Starter line includes control for squirrel-cage, synchronous and wound rotor motors. Specify them for full or reduced voltage starting . . . for reversing or dynamic braking. When considering a single starter, or a control group consisting of several starters . . . Allis-Chalmers Type *H* Starters will be your right answer. If you have a special application, a staff of specially trained control experts will help you to meet the problem of your particular installation. Call your nearby A-C Sales Office or write direct for bulletins 14B6410 and 14B7303.

YOUR CHOICE OF CONTACTOR

Oil or Air — whichever contactor is best suited to your application is standard in Allis-Chalmers Type *H* Starters. Both are designed for ready access and built to give long life with low maintenance.

AIR BREAK CONTACTORS: are easier and cleaner to maintain; have longer lasting contacts; are preferred for highly repetitive duty; reduce fire hazard; and type 256 fits in same cubicle as oil immersed contactor.



OIL IMMERSED CONTACTORS can be used in dust laden atmospheres; atmospheric contamination will not interfere with proper operation; initial cost is lower; less space is required for reduced voltage starting.

Complete Protection for Men, Motors and Machines

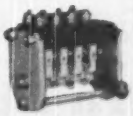
SHORT CIRCUIT PROTECTION: Current limiting power fuses mean complete short circuit protection without limiting motor torque or causing unnecessary current interruptions.

Fuses are silent and dry —emit no flame or gas and provide indication when

they blow. They are not affected by starting current or stalled rotor conditions. They provide short circuit protection up to 150,000 kva at 2300 volts and 250,000 kva at 4160 and 4600 volts.

OVERLOAD PROTECTION: Accurate thermal overload protection is provided by *Type 194* overload relays. They automatically recalibrate themselves to compensate for variances in ambient temperature so that the heating element is affected only by motor current.

TIME DELAY UNDERVOLTAGE PROTECTION is provided in every Type *H* Starter. A multi-stage auxiliary switch provides for extra control circuits. This switch is of the drum type, with two breaks in series for each stage.



ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

A-2951

Other Allis-Chalmers Special Control

SYNCHRO-OPERATOR — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.

D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, ordar telegraph, etc.

REGULEX CONTROL — Used where the features of a rotating type regulator are desired.

Regulex is an Allis-Chalmers trademark.

Positive Action... Easy to Fuse

PE 33 years of "Know-how"

Southern States'
Porcelain-Enclosed
Dropout
Distribution
Cutout

- Designed for full dropout operation. Can be converted to 100 amp disconnecting switch by substitution of solid blade door assembly.
- The safest cutout made! Door completely dead when open. The PE-33 can be entirely hookstick operated and fused with SS bayonet-type hookstick or a clamp type stick. Door can be opened and closed by ANY hookstick, and removed and replaced by hand.
- High pressure contact maintained by phosphor bronze back-up springs on silvered contact surfaces.
- Mounting bracket meets NEMA and EEI standards for universal use with cutouts and lightning arresters.

Immediately available through your local jobber in the following ratings:
5 kv 50 amp
7.5 kv 50 amp

Southern States Equipment Corp.

HAMPTON GEORGIA

Representatives in:

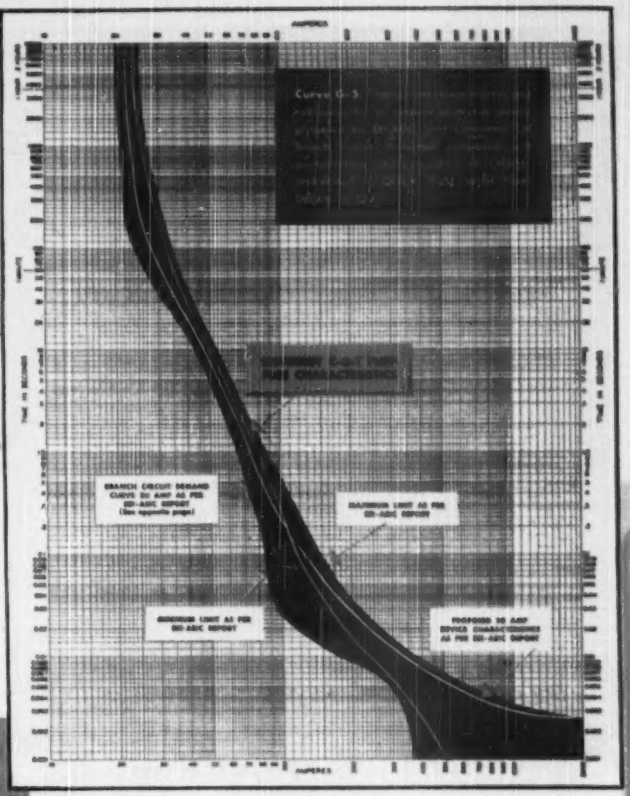
BIRMINGHAM, ALA.	CHICAGO, ILL.	MINNEAPOLIS, MINN.	MEMPHIS, TENN.
LOS ANGELES, CALIF.	EVANSVILLE, IND.	KANSAS CITY, MO.	DALLAS, TEX.
SAN FRANCISCO, CALIF.	VALPARAISO, IND.	ST. LOUIS, MO.	EL PASO, TEX.
DENVER, COLO.	LOUISVILLE, KY.	NEW YORK, N. Y.	HOUSTON, TEX.
WASHINGTON, D. C.	NEW ORLEANS, LA.	CHARLOTTE, N. C.	LUBBOCK, TEX.
JACKSONVILLE, FLA.	SHREVEPORT, LA.	PHILADELPHIA, PA.	SALT LAKE CITY, UTAH
MIAMI, FLA.	BOSTON, MASS.	CHARLESTON, S. C.	SEATTLE, WASH.
ATLANTA, GA.	JACKSON, MICH.	KNOXVILLE, TENN.	MILWAUKEE, WISC.

New C-Q-T Plug Fuse Gives

1. LONG TIME-DELAY...
enough to start a heavy washer.

2. SENSITIVITY...
enough to protect a cord.

HERE IT IS! See how the performance curve of the Shawmut C-QUICK FUSE WITH TIME-DELAY (C-Q-T) compares with the time-current characteristics for 20 ampere protective devices proposed by the EEI-AEIC Joint Committee on Branch Circuit Protection (Curve G5, page 30 of EEI-AEIC Report).



Shawmut C-Q-T Fuses, approved by Underwriters' Laboratories, Inc., come in the following ratings and color codes: 15 amp — blue; 20 amp — orange; 25 amp — red; 30 amp — green. Also in same ratings without color coding at slightly lower price.

Specify the NEW SHAWMUT C-QUICK PLUG FUSE WITH TIME-DELAY (C-Q-T)

A quick study of the above chart shows you that the Shawmut C-Q-T Fuse gives even better protection than the device proposed in the EEI-AEIC Report . . . *longer safe time-delay in the overload range . . . faster action in the short-circuit range.*

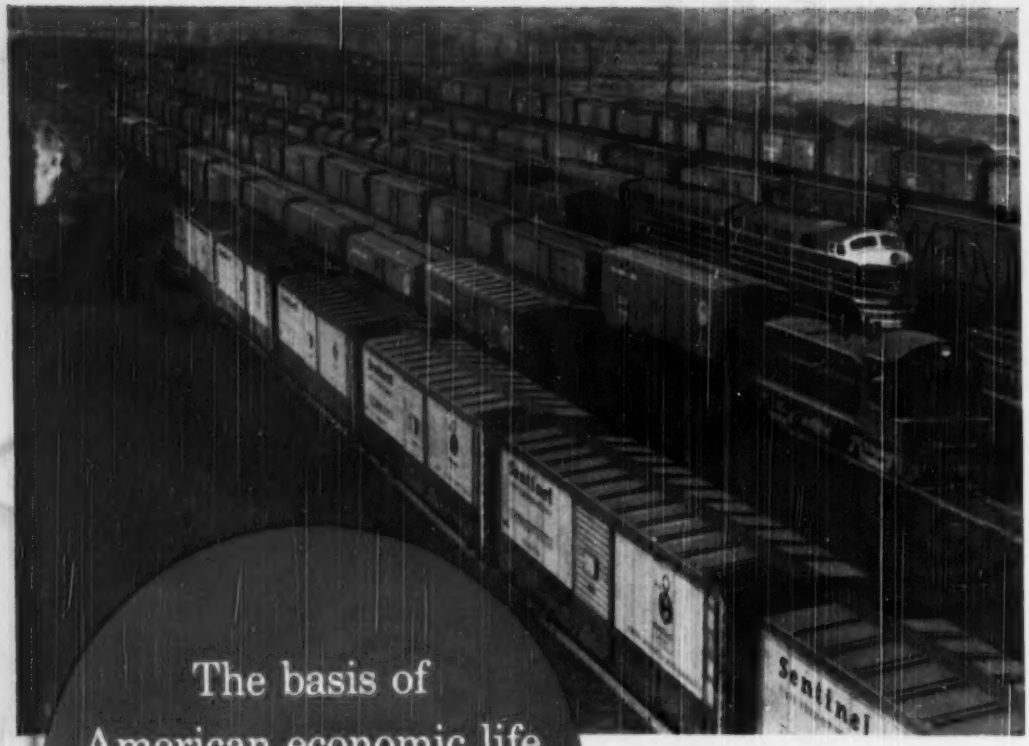
Designed for the average household branch circuit carrying a mixed load of appliances, it allows heavy-drawing appliances like washing machines to start and operate through their entire cycle. No needless fuse blowing . . . yet assures protection to lamp cords.

WRITE FOR FREE BULLETIN

For further details about Shawmut C-Q-T Fuses, write for bulletin. It gives you all the facts you should know about branch circuit overload protection. THE CHASE-SHAWMUT COMPANY, 370 Merrimac Street, Newburyport, Mass.

SINCE 1893

SHAWMUT Circuit-Matched FUSES
Insure More Accurately Engineered Protection For Any Circuit



The basis of American economic life is common-carrier transportation by rail—

the only form of transportation which can and does handle anything, anywhere, anytime, in any quantity, for anyone.

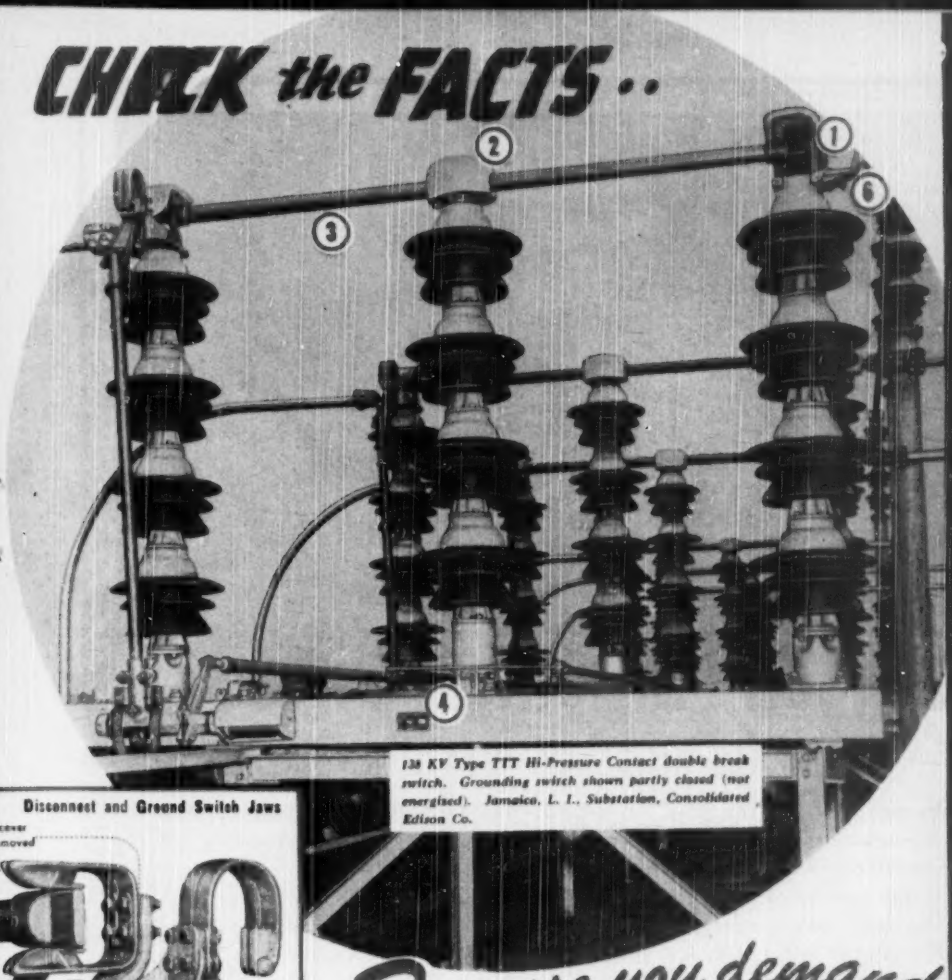
*For such service at its best—**Ask our man!***

BALTIMORE & OHIO RAILROAD

Constantly doing things—better!

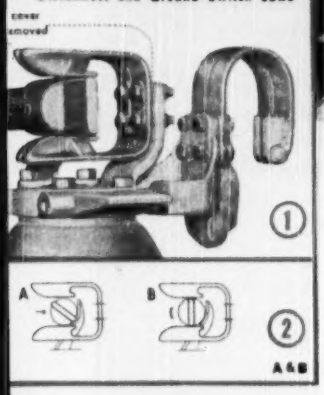
LINKING 13 GREAT STATES WITH THE NATION B&O

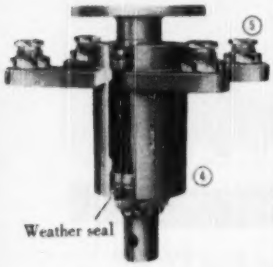
CHECK the FACTS..



138 KV Type TIT Hi-Pressure Contact double break switch. Grounding switch shown partly closed (not energised). Jamaica, L. I., Substation, Consolidated Edison Co.

Disconnect and Ground Switch Jaws





Because you demand your switches RUGGED

1. **CONTACTS**—Hi-Pressure, self cleaning, beryllium jaws. Proper pressure, plus a clean contact makes a dependable electrical and mechanical contact.
2. **BLADE MECHANISM**—rotates one-piece tubular blade, AFTER blade enters jaw free of pressure—all with continuous motion.
   - A—Blade in closed position by insulator rotation.
   - B—Contact closed by blade rotation.
3. **ONE-PIECE BLADE**—High strength, high conductivity I. P. S. tubing.
4. **BEARING**—weather sealed, greaseless for smooth easy operation.
5. **LEVELING SCREWS** for alignment - also featured on all insulator stacks.
6. **TERMINAL**—four half-inch bolt, clamp type.

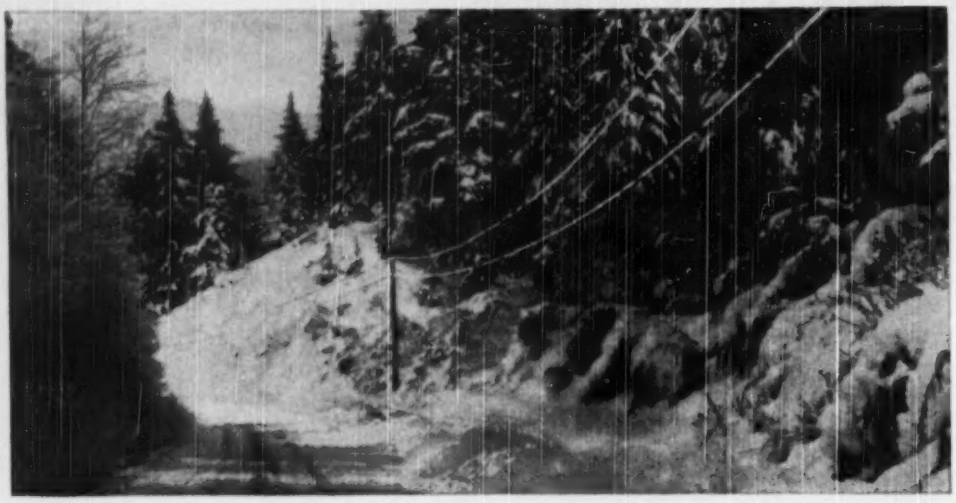
R&IE

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SWITCHING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES



Rugged "Staying Power"

IN ALL KINDS OF WEATHER

The real test of an overhead line comes when winter blasts your conductors with sleet, ice and high winds. And that's when you can rely on Copperweld-Copper Conductors for dependable service!

The copper-protected alloy steel core of Copperweld* wire provides high tensile strength to withstand the heaviest ice loads. The solid copper wires stranded with it assure highest conductivity. And the triangular shape of this 3-strand conductor minimizes vibration because of the irregular surface exposed to winds.

Certainly, you'll find it pays to standardize on Copperweld-Copper Conductors. They possess the added strength and safety required for long span construction. They provide extra "staying power" and longer life—at lowest overall cost.

*Trade Mark

COPPERWELD STEEL COMPANY

GLASSPORT, PA.

Sales Offices in Principal Cities

WORLD'S FIRST MERCURY UNIT POWER PLANT*

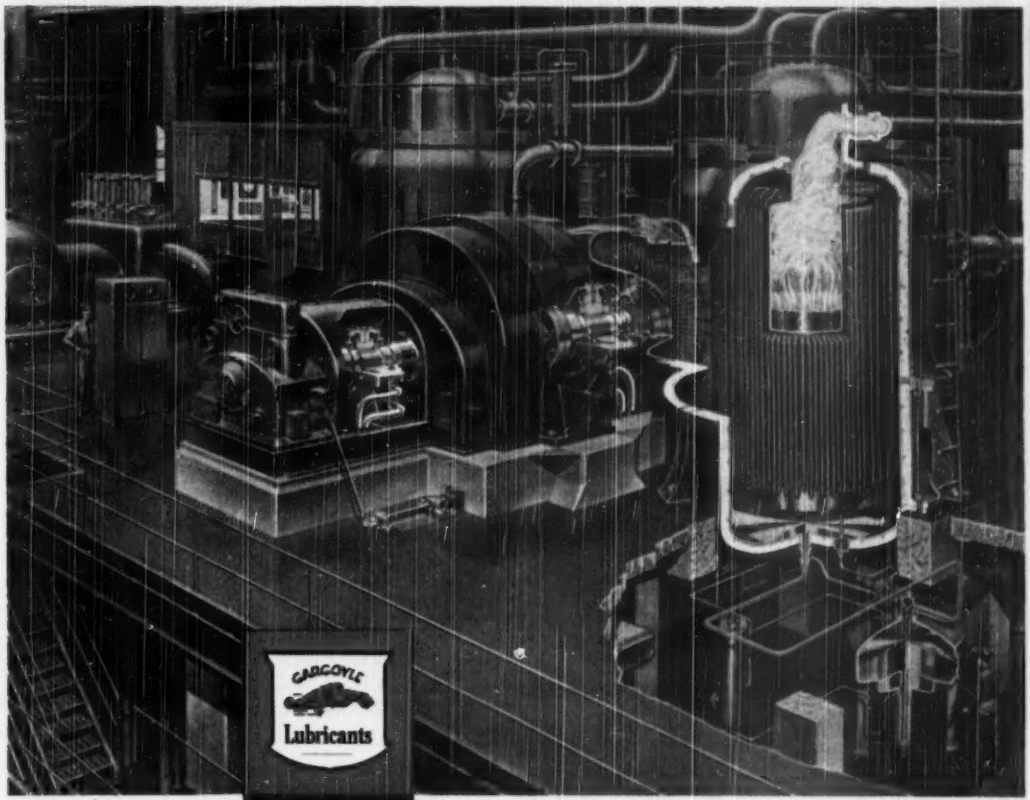
...gets the World's Greatest Lubrication Knowledge and Engineering Service

THIS unique mercury-steam turbine combination was built by General Electric for the Public Service Company of New Hampshire.

The new plant—now in operation in Portsmouth—teams two 7,500-kw mercury turbines (one cut open, center) with a single 25,000-kw steam turbine (left). Mercury vapor, which runs the smaller turbines, generates steam when it is condensed for re-use. This steam, in turn, is superheated and used to power the larger turbine. There are no fuel-fired steam boilers.

This first mercury unit power plant—like so many other "firsts" in industry—is lubricated 100% by Socony-Vacuum. Famous Gargoyle D.T.E. Oil 797 helps protect costly bearings and other parts. Other Gargoyle Oils help keep auxiliary equipment on the job.

Why not get the world's greatest lubrication knowledge for *your* plant, too?



*The first mercury-steam power plant designed and co-ordinated as a unit station.

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY GENERAL PETROLEUM CORP.

SOCONY-VACUUM

SOCONY-VACUUM

Correct Lubrication

STRIKE?

no..they're out because of a broken bolt!

You're looking at a group of production workers who have been laid off temporarily—because a certain bolt in an all-important drive corroded to failure.

One of the most regrettable aspects of this situation is that it *could* have been avoided... by specifying non-ferrous or stainless steel fastenings at the time the equipment was purchased; or by replacing common steel fastenings *on delivery* with bolts, nuts, screws, rivets and accessories that *resist* corrosion.

Harper specializes in these Everlasting Fastenings; makes them in over 7000 different sizes, types and alloys—Brass, Bronzes, Copper, Monel and Stainless Steels. Large quantities are maintained in stock for immediate delivery to manufacturers everywhere who know by experience the extra qualities you get in Harper fastenings—better appearance, longer life, ease of cleaning and resistance to high temperatures. They're most economical in the long run.

Write today for 134-page catalog and current stock list. The H. M. Harper Company, 8205 Lehigh Avenue, Morton Grove, Illinois

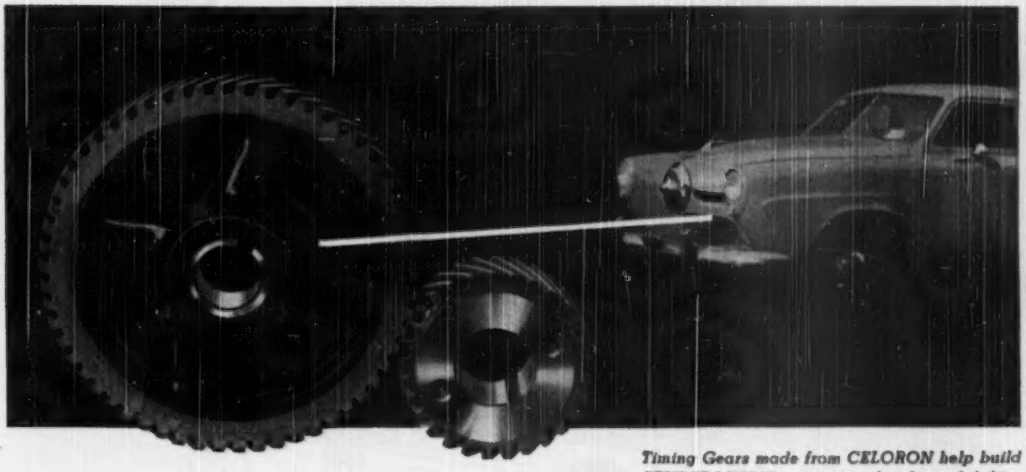
New York Office and Warehouse: 200 Hudson St.
Los Angeles Office and Warehouse: 835 E. 31st St.
Branch Offices: Atlanta, Cambridge, Cincinnati, Cleveland, Dallas, Denver, Detroit, Grand Rapids, Milwaukee, Oakland, Philadelphia, Pittsburgh, St. Louis, Seattle, Toronto (Canada)

AMERICA'S LEADING SPECIALIST IN NON-FERROUS AND STAINLESS STEEL FASTENINGS

HARPER

EVERLASTING FASTENINGS

CELORON
. . . what's in it for you and your products?



Timing Gears made from CELORON help build STUDEBAKER'S reputation for dependability.

What's in CELORON for you . . . and your products? This different thermo-setting plastic maintains strength and resiliency at temperatures up to 290°F. Resists oil, water and many corrosive chemicals. It is 1/6 the weight of steel—only 1/2 the weight of aluminum! Remarkably easy to machine, Continental-Diamond's CELORON gives you an unusual combination of light weight, high strength, and wear resistance *plus* electrical insulating properties.

CELORON is another example why it pays to see C-D first in your search for the right plastic. For plastics that provide *practical* combinations of mechanical and electrical properties, call your nearest C-D office. Trained technicians on hand at all times to help with your material selection problems.

CELORON—ideal for many mechanical and electrical applications

Specific Gravity	1.35	Impact Strength (Izod) (per inch of notch)	2.3 Ft. Lbs.
Tensile Strength	6,500 psi	Brinell Hardness—500 kg. load	38
Flexural Strength	10,000 psi	(10 mm diameter ball—30 seconds)	
Compression Strength	25,000 psi	Rockwell Hardness	M105
Shearing Strength	8,500 psi		

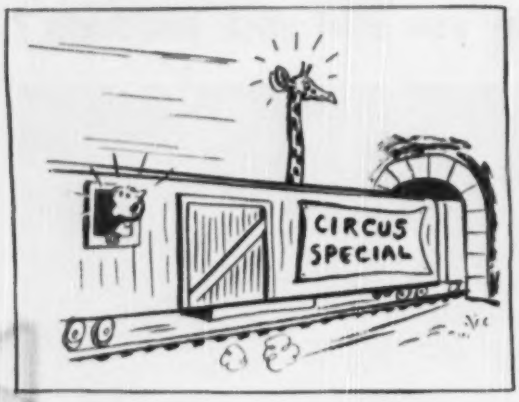
DE-1-50

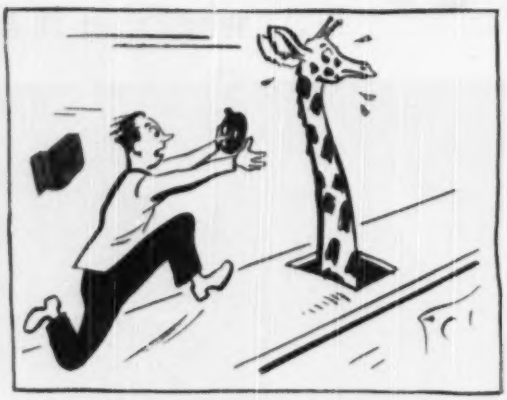
BRANCH OFFICES: NEW YORK 17 • CLEVELAND 14 • CHICAGO 11 • SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES.
WEST COAST REPRESENTATIVE: MARWOOD LTD., SAN FRANCISCO 3 • IN CANADA: DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

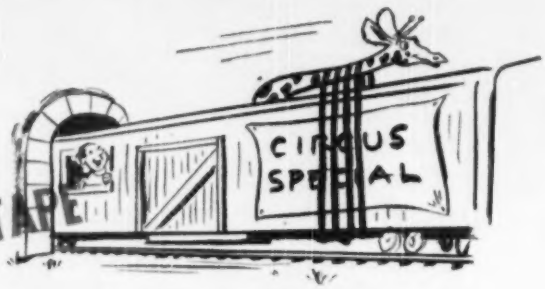
Established 1895 . . . Manufacturers of Laminated Plastics since 1911 — NEWARK 15 DELAWARE

You can do a lot





with a little GOLD SEAL TAPE



Here's a tape you can count on to speed any job — and stick to the job. And a roll of Jenkins Gold Seal will always go further, because there's no waste.

What a difference it makes, working with tape that tears evenly, quickly. It will not dry out, peel or ravel, yet makes a tighter, longer-lasting bond. Production is carefully controlled to assure lasting "tack" in the friction compound.

No wonder Gold Seal is the lasting favorite of linemen and electricians! There's more tape value in every roll. Buy 'em by the carton (10 rolls) or singly. Each roll individually wrapped in cellophane to keep it *factory-fresh*. Jenkins Bros., (Rubber Division), 80 White St., New York 13, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

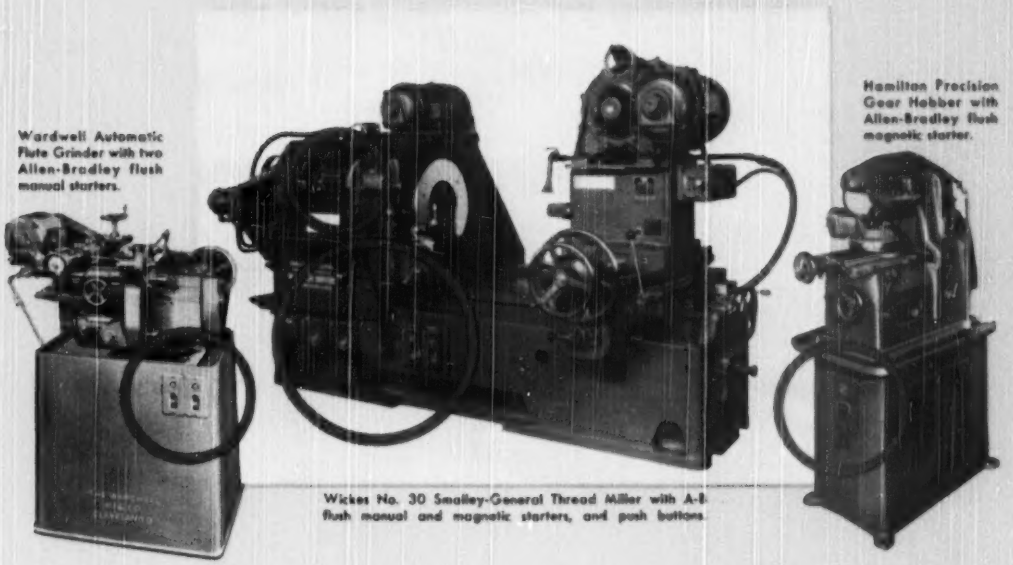
JENKINS *Gold Seal Tapes*

FRICTION and RUBBER TAPES

MADE BY JENKINS BROS., MAKERS OF FAMOUS JENKINS VALVES

Built-in Motor Controls

modernize the appearance of your shop



Wardwell Automatic Flute Grinder with two Allen-Bradley flush manual starters.

Wickes No. 30 Smalley-General Thread Miller with A-B flush manual and magnetic starters, and push buttons.

Hamilton Precision Gear Hobber with Allen-Bradley flush magnetic starter.

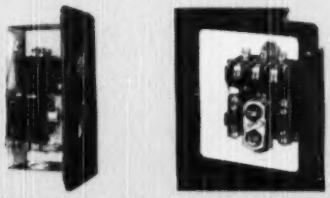
Many machinery builders are now equipping their motorized machines with flush mounted controls. Above are a few examples of machines with "built-in" push buttons and motor starters.

Notice the smooth appearance of the machine bases. There are no control boxes to break the streamlined design . . . no exposed conduits to clutter the installation.

When designing special machinery for your own plant, streamline its appearance with built-in controls. We shall be glad to send descriptive literature on these flush type starters.

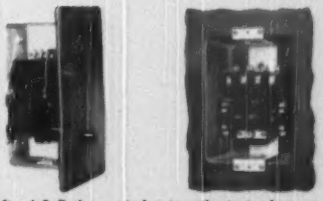
Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.

BULLETIN 609 MANUAL STARTER



At left—A-B flush mounted manual starter in open type construction for enclosed recesses. At right—A-B manual starter in flush mounted cabinet for installation in open recesses.

BULLETIN 709 MAGNETIC STARTER



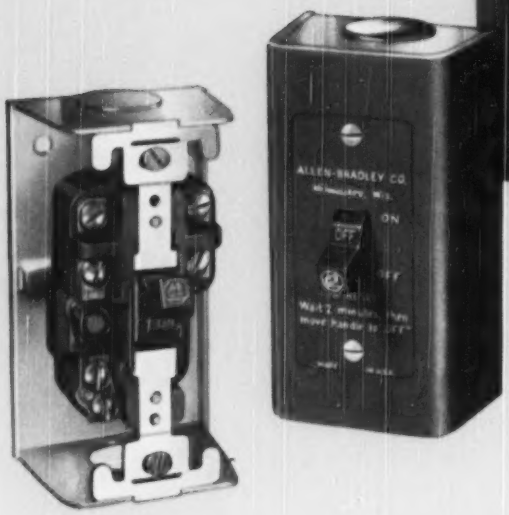
At left—A-B flush mounted automatic starter in open type construction for enclosed recesses. At right—Form 1 A-B unit installed in enclosed machine recess, with cover off.

A-B Quality

ALLEN-BRADLEY

QUALITY

TROUBLE FREE MOTOR STARTERS



with RELIABLE OVERLOAD PROTECTION

For Fractional Horsepower Motors

The National Electrical Code requires overload protection for all fractional horsepower motors started automatically or by remote control. The Bulletin 600 switch satisfies this need. Its dependable, accurate, thermal breaker trips the switch under a sustained overload, and protects the motor against burnout.

QUICK MAKE AND BREAK CONTACTS—The simple, rugged, over center mechanism provides quick make and quick break contact action . . . therefore, long contact life.

GENEROUS WIRING SPACE—Though compact, this small switch provides plenty of wiring space. Its metal cover slips off, exposing front and two sides.

EASY TO INSTALL—No need to remove the starter from the enclosure during installation—saves at least 10 minutes of installation time.

ATTRACTIVE APPEARANCE—This starting switch, with its clean, modern lines, is a sales asset to any motorized machine.

Allen-Bradley Company
1316 S. Second St., Milwaukee 4, Wis.

ALLEN-BRADLEY

BULLETIN 600 STARTING SWITCHES FOR SMALL MOTORS

A-B Quality

the modern approach to street lighting cable

The modern trend in street lighting cable is away from rubber-lead parkway and rubber plus neoprene—which are being replaced rapidly by all-plastic cables like Ansonia Ankoseal.

The ample reasons for this are light-weight and longer service life.

Because it is so much lighter to handle and also is easy to splice, the installed cost per foot for Ansonia Ankoseal shows a distinct saving. Because it is inert *all the way through* Ansonia Ankoseal resists attack from earth acids, duct water, oils and other contaminations that eventually ruin the old-type cables.

Ansonia Ankoseal can be supplied shielded or unshielded, according to customer's preference.

calls for all-plastic

ANSONIA
Ankoseal Cables

If you have not heard the complete story of these new cables, an Ansonia engineer will be glad to explain the advantages.

THE ANSONIA ELECTRICAL COMPANY

SUBSIDIARY OF NOMA ELECTRIC CORPORATION

ANSONIA, CONNECTICUT

how GOOD can PLANNED LIGHTING be

without good equipment?

THE answer is—no better than a building plan without good building material. There is no dodging the fact that Good Equipment is the BASIC factor in a GOOD LIGHTING PLAN. It is the lighting units, the lampholders, the ballasts, the reflector, etc., which MAKE or BREAK the final results, in terms of sustained lighting efficiency, low-cost maintenance and dependable operation.

That's why, no matter how good the Lighting Plan, the results may be disappointing unless the plan includes GOOD EQUIPMENT.

the PUBLIC must be BETTER INFORMED on the importance of GOOD lighting equipment

As an industry, and as individual business men, we fail in selling PLANNED LIGHTING when we do not sell the importance of GOOD EQUIPMENT at the same time. It is our obligation that we keep faith with our customers by giving them the UNVARNISHED FACTS about the DIFFERENCE between GOOD and INFERIOR or SUBSTANDARD EQUIPMENT in terms of the factors listed below.

The buyer is entitled to KNOW these facts and to be TOLD and SHOWN that there are POSITIVE PROTECTIONS provided by the lighting industry, which assure him that the equipment he buys is in the GOOD EQUIPMENT BRACKET . . . the QUALITY BRACKET. *Proof of Quality* in lighting equipment is MADE EASY through such proof elements as:

CERTIFIED BALLAST LABEL

RLM LABEL

UNDERWRITERS' LABORATORIES LABEL

ELECTRICAL TESTING LABORATORY TESTS

These provide the buyer not only with the assurance that MINIMUM STANDARDS for performance have been met, but also that UNIFORM QUALITY is continuously maintained from one piece of equipment to the other.

FREE Booklet . . . The RLM Standards Institute has published a booklet containing the detail of each specification for each type of lighting unit for which RLM Standards have been established, as well as a complete summary of the IMPORTANCE OF THE LABEL in terms of CUSTOMER BENEFITS.

How the RLM Label provides assurance that the equipment is of uniformly high quality is shown through an outline of the RLM CONFORMANCE PROGRAM. Under this program, the Electrical Testing Laboratories make periodic tests of samples obtained from factory or market place to make sure that all equipment bearing the RLM Label consistently and continuously adheres to RLM Standards.

Make the RLM BOOKLET a part of every Planned LIGHTING PROPOSAL! . . . Write to the RLM Standards Institute for your COMPLIMENTARY COPY (or copies) of the RLM SPECIFICATION BOOKLET *today*. Plan to attach a copy to every PLANNED LIGHTING proposal you submit . . . let it help you point out to your customers that GOOD EQUIPMENT IS BASIC to GOOD PLANNED LIGHTING.

the PUBLIC is entitled to KNOW these FACTS about GOOD LIGHTING EQUIPMENT

CONSTRUCTION: Good Lighting Equipment features structurally sound fabrication and heavy steels for maximum resistance to sag, distortion and breakage.

FINISH: Good Lighting Equipment features reflector finishes that insure your getting all the light you pay for . . . this year and ten years from now! That is why good equipment so overwhelmingly features PORCELAIN ENAMEL—the one and only commercially available finish that cannot deteriorate or corrode, regardless of the industrial atmosphere. Additional advantages of Porcelain Enamel are (1) that it is the only finish whose original efficiency can be sustained year after year by simply washing it with soap and water, and (2) that it is UNSURPASSED as a reflecting surface, because it ideally combines a high reflection factor with a high diffusion factor, insuring high light output with a minimum of glare.

REFLECTOR DESIGN: Good Lighting Equipment insures good lighting through reflector design that conforms to the most accepted principles of Illuminating Engineering. Such design protects the workers' eyes while delivering, not only the *most light* per dollar, but also the *required quality of light* for the individual Seeing Task.

SOCKETS, STARTERS, LAMPHOLDERS: Good Lighting Equipment features ruggedly constructed parts that withstand years of use and embody special design which facilitates quick, money-saving maintenance and low-cost operation.

BALLASTS: Good Lighting Equipment insures you against trouble by employing only the highest quality certified ballasts. Ballasts last longer because sound electrical and mechanical design prevents high temperature ballast operations. Lamps last longer because certified ballasts supply proper starting current and maintain proper operating watts to the lamp. Present wiring capacity is used most efficiently by the high power factor of quality ballasts.

This Advertisement is published in the interest of the Entire Lighting Industry by

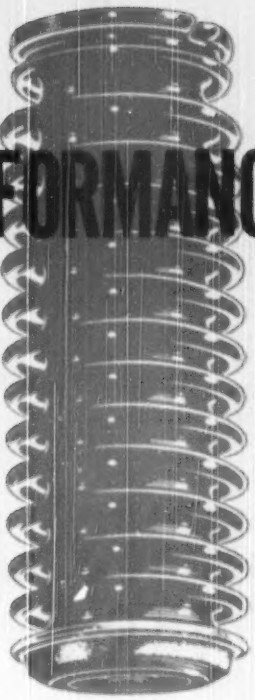
RLM STANDARDS INSTITUTE

The Lighting Standards for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE, SUITE 821, 326 W. MADISON ST., CHICAGO 6, ILL.

B3487

Do You Buy Sales talk or PERFORMANCE?



LAPP LINE POST

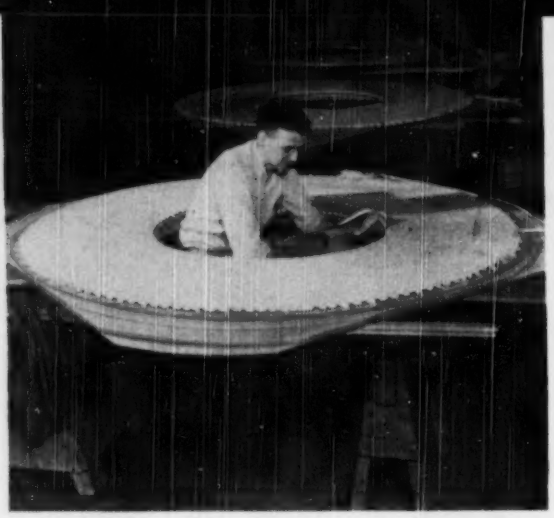
We sell dependable performance. *Proven* performance. By now most companies have at least tried Lapp Line Posts, so the odds are you've got some Line Posts in service—maybe on what used to be a trouble-spot. It will be worth your while to study their performance record. We bet you'll find—as everyone who keeps performance records on Lapp Line Posts reports—that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator.* Eighteen years of performance prove it. Now's the time to consider standardizing your transmission lines on Lapp Line Posts if what you want, in addition to endurance, economy, and functional beauty, is maximum performance. You can't afford *not* to.

PERFORMANCE IS PROOF

Lapp INSULATORS

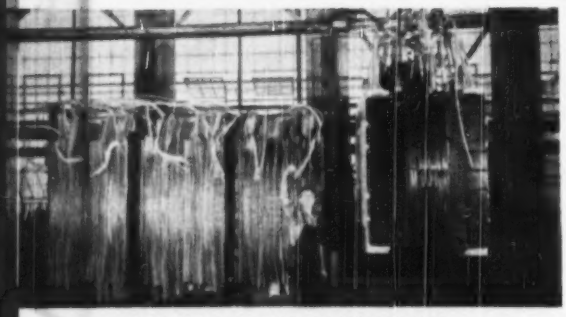
LAPP INSULATOR CO., INC. • LE ROY, N.Y., U. S. A.

1. GOING OVER PLANS, engineer J. R. Mann discusses terminal board design with designers Kotz and Reinemann. Detailed engineering included corona-free design for every part of transformer.

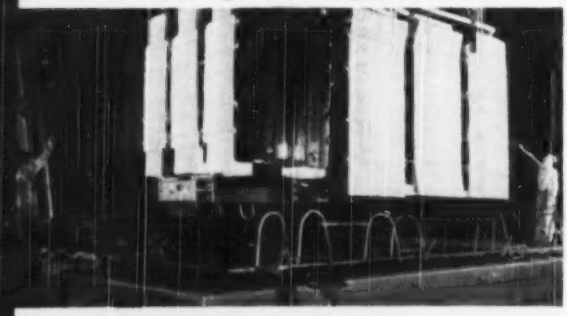


2. ACTUAL CONSTRUCTION STARTS with fabrication of windings. Here, workman tapes inside connection on pair of 78" coils. Circular design is used to reduce strain under short circuit conditions.

NATION'S LARGEST TRANSFORMER TIES IN TRI-STATE POWER



3. LOWERING SERIES TRANSFORMER into position. Shell type construction permitted impedance matching of multiple windings without sacrifice of insulation strength; at same time, freed windings from blanketing layers of insulation.



4. LASTING DIELECTRIC STRENGTH is gained by thorough vacuum drying. Eight day treatment in chamber above removed over 2000 lbs. of water from core and coil assembly!

201 Ton Giant Interconnects Three Major Utilities in Arkansas, Missouri and Kansas

LINKING THREE MAJOR POWER SYSTEMS — all at different voltage levels — is the assignment behind this record breaking transformer.

Purpose of the tie-in is to increase flexibility and economy of operation for the systems involved. These systems are: Empire District Electric (purchaser), Arkansas Power and Light, and Kansas Gas and Electric.

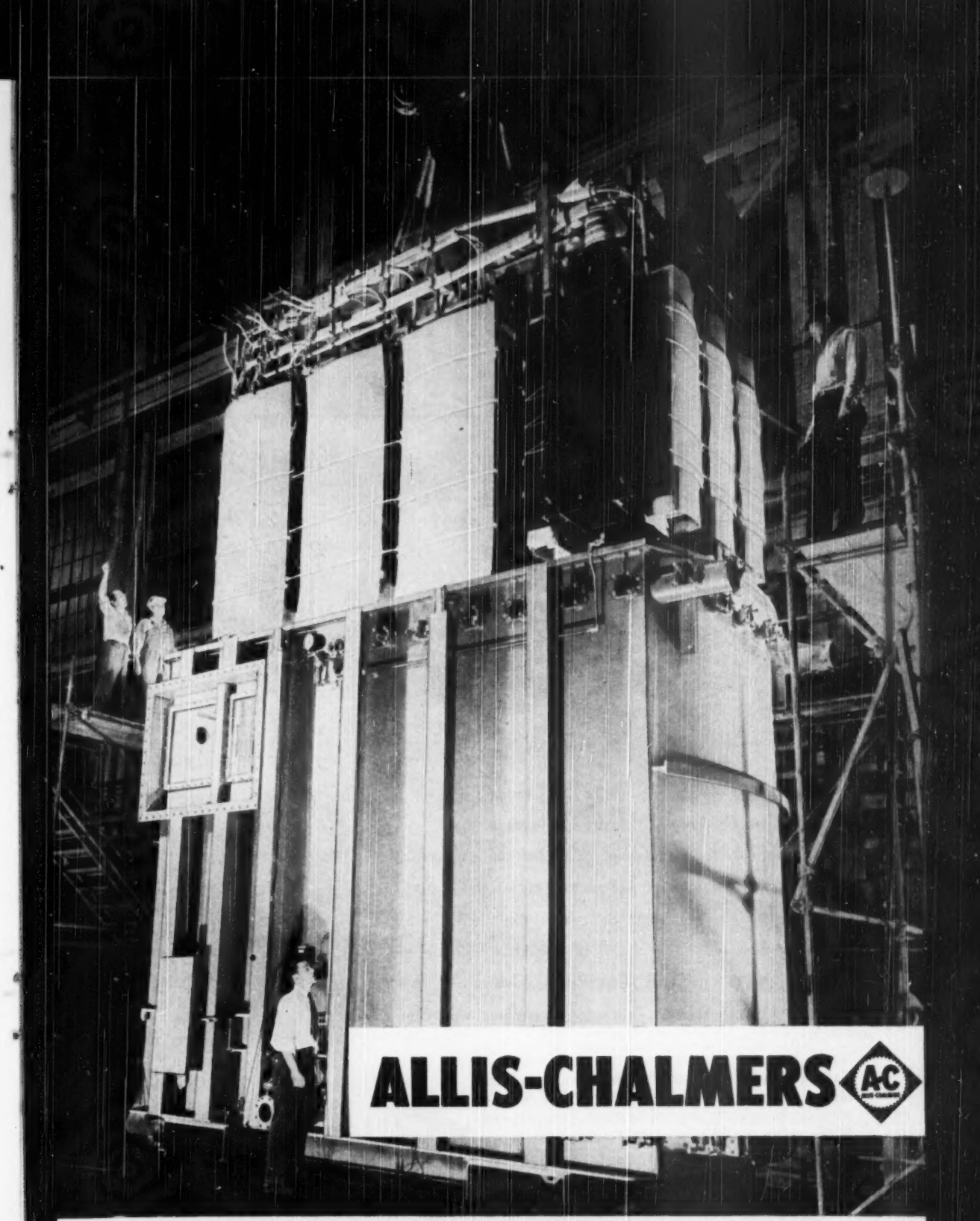
To build a transformer to meet the requirements of this job called for a certain amount of special engineering. Multiple main windings, for example, had to be designed to furnish up to 40,000 kva at voltages of 161, 132, 69 and 13.2 kv. On top of this, it was necessary to incorporate a 132 kv, 4300 kva series transformer for load ratio control.

But basically it was a matter of applying Allis-Chalmers wide background of existing design knowledge to a new and larger problem.

Completion of this record size transformer is another example of Allis-Chalmers' ability to engineer power transformers in *any* rating . . . to fit *any* system needs.

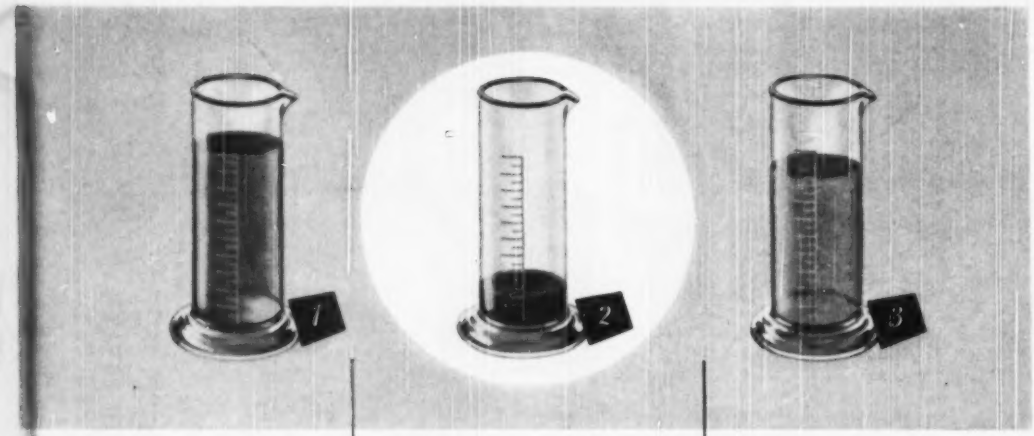
A-2930

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



5. IT'S A SNUG FIT as 86 ton core and coil assembly is lowered into tank. Coils are still warm from vacuum drying process at this stage. Before they have a chance to cool, "dry" (moisture-free) oil will be added to assure lasting performance during many years of operation. Finally, transformer will receive electrical and pressure tests; will then be shipped on special car to permanent site.

How Alchlor Process "Remove-ability"* gives Gulfcrest Oil its greater stability



In Cylinder 1 you see the oil that will become Gulfcrest. It has gone through the usual steps used in refining most other turbine oils—but has not yet been Alchlor-processed — an extra refining step that makes it extra pure and extra efficient.

* In Cylinder 2 you see the part—as much as 15%—which is discarded by the Alchlor Process. This is the part that, in ordinary turbine oils, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company

Offices in Principal Cities in 30 States

GULF INDUSTRIAL LUBRICATION

throw away
your paint brush

get ELEMEX capacitors in Stainless Steel tanks

. . . with L-M "Lifetime" solder-sealed bushings
. . . in 15 and 25 kvar sizes in standard voltage ratings
. . . LOW UNIT STRESS for long service life

One utility company estimates that it costs $8 per unit to repaint capacitors. *Whatever* it costs is *too much*—when you can get *good* capacitors like ELEMEX in *stainless steel tanks!* And that's not even considering all their other advantages. They're pretty swell jobs; we think it would be worth your time to take a good look at them!

Stainless steel tanks mean no painting, ever! They also mean that the lineman doesn't have to take time to scrape paint to get a good ground. Tanks are "Hydis" treated—for good heat dissipation.

OTHER ELEMEX ADVANTAGES

Uniform terminal elevation—another time-saving feature. The 15's and the 25's have the same terminal elevation above the hanger in each voltage class. No change in leads when you replace or mix 15 *kvar's* with 25's. The 25's are 5¼" longer *below* the hanger, so they're easy to identify from the ground. All sizes same width and thickness, fit same hanger bolts.

"Paragroove" Connectors, another L-M "first": wire is just dropped in and clamped; no crossing of leads, no loose parts. L-M "Lifetime" solder-sealed bushings keep air out, keep ELEMEX liquid in—permanently.

Low unit stress: conservative design assures long life. **Safer:** discharge resistors across every pack or parallel group of packs. **Individual Testing** of packs, tanks and completed capacitor before, during, and after impregnation assures uniformity, long life.

Continuous individual evacuation, drying, and capillary impregnation with ELEMEX non-inflammable dielectric assure precise control of power factor and capacitance—an exclusive L-M research development.

ELEMEX capacitors have an outstanding 5-year service record . . . negligible rate of failure . . . *not one* leaky bushing . . . and thanks to the L-M braced sealed carton, only one has broken in shipment! A good record, don't you think?

WANT MORE INFORMATION?

Want details on ELEMEX? Data on capacitor application, uses, savings, power factor calculation? L-M's engineering staff will be glad to help you. **Ask the L-M Field Engineer** to get you the information you need, *or write* **Line Material Co., Milwaukee 1, Wisconsin.** 6983 A

LINE MATERIAL Capacitors

Complete Coordinated Equipment for All Distribution Requirements

Phantom view of line conductor clamp. Jaws designed to prevent deformation of conductor. Tightened by two screws from front of cutout.

Insulation is skinned from about four inches of the conductor, which is then dropped into the slot in top of the cutout.

L-M PVD-562 Drop-out Indicating Cutout, 50 amps, 3000 V. Flexible synthetic hood grips top of housing and protects cut ends of insulation, completely weatherproofing the job.

why get complicated?

It's so simple to hook up aerial cable to

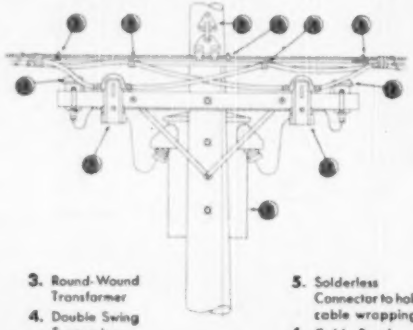
L-M's PVD-562

aerial cable FUSE CUTOUT

You don't need a truckload of equipment and a lot of complicated connections when you use the new L-M Aerial Cable Fuse Cutout. It's the first drop-out cutout designed especially for aerial cable. It's a tremendous help when you install aerial cable.

You don't cut the cable. Just skin it, and drop it into the slot. Copper-jawed clamp centers the cable, and grips it firmly without distorting the conductor. Flexible synthetic hood waterproofs the top of the cutout box and protects cut ends of the insulation. Ears of the hood are wrapped around the cable and taped. A neat, efficient installation that's fast and easy to make.

The L-M PVD-562 has the same indicating and operating features as the famous PVD-56. But it's designed especially for aerial cable. For details, ask the L-M Field Engineer for Bulletin AC1, or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company Division).



Installation of L-M Aerial Cable Cutout with Single Phase Transformer. No tee taps needed. You don't even cut the conductor!

1. PVD-562 Fuse Cutouts
2. Valve Type Lightning Arrester
3. Round-Wound Transformer
4. Double Swing Suspension Bracket
5. Solderless Connector to hold cable wrapping
6. Cable Band

LINE MATERIAL...Aerial Cable Materials

Complete Coordinated Equipment for Distribution Today

745

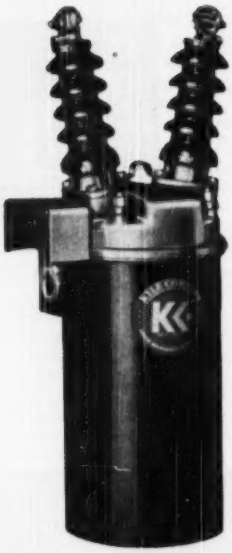
KYLE RECLOSERS

KYLE reclosers offer complete protection for lines, and safety for linemen. They are the original, and still the best, automatic protection for both single and three-phase lines. They offer flexibility to meet all conditions, and precise coordination with fuses, sectionalizers, other reclosers, and station breakers. They avoid lockouts and outages, cut maintenance, and protect your equipment and service.

Outstanding Kyle Recloser Features

Three reclosures before locking out; choice of four opening sequences . . . Coils and sequences easily changed in the field . . . Trip-free operating handle. Tank and cover are dead; bushing terminals are the only live parts . . . Positive dependable operation—no motors or clockwork . . . Large cast aluminum cover; sleet hood protects operating handle and counter . . . Ratings 5 to 50 amps.; 2400 to 15,000 volts; minimum tripping current 10 to 100 amps.; interrupting capacity 150 to 1200 amps.

. . . ON SINGLE-PHASE . . . AND THREE-PHASE LINES

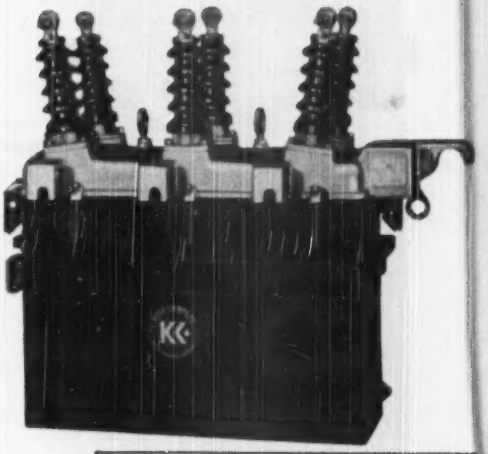


◀ KYLE
TYPE H
Single-phase recloser

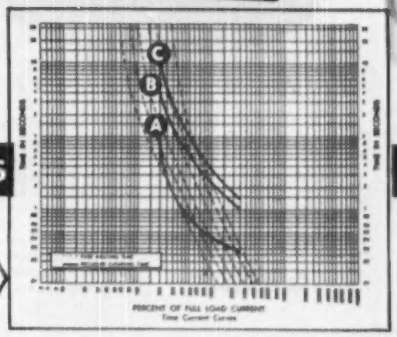
Protects feeders and branch lines on both single- and three-phase systems by coordinating with fuse links, sectionalizers, and other reclosers. Isolates permanent faults to small parts of a system and thus cuts amount of patrolling required.

KYLE ▶
TYPE 3H
Three-phase recloser

A practical combination of single-pole units so as to permit single-phase operation of any of the three-phase units so long as no lockout is required. If any one unit locks out, the other two lock out simultaneously. Prevents "single phasing" and overloading and burning out 3-phase motors. 7119



CHOICE OF 4 OPENING SEQUENCES



Curves show recloser action on each sequence:

1. Curve A—four fast openings.
2. Curves A and B—two fast, two retarded openings.
3. Curve C—four extra retarded.
4. Curves A and C—two fast and two extra retarded.

For complete information ask the L-M Field Engineer or write Line Material Company, Milwaukee 1, Wisconsin (A McGraw Electric Company division).

LM

LINE MATERIAL Kyle Reclosers

7119

Complete Coordinated Equipment for All Distribution Requirements

KYLE TYPE GS AUTOMATIC OIL SECTIONALIZER

Isolates permanent faults on branch lines of recloser-protected systems

Kyle automatic oil sectionalizers provide dependable automatic protection against permanent faults on branch lines. They do not open on temporary faults, but operate to disconnect the branch only after one, two, or three operations of the back-up recloser have failed to clear the fault. After the third recloser operation, the contacts of the sectionalizer open up while the recloser is open. Thus the faulted branch is disconnected, and the recloser resets itself and maintains service on the rest of the system.

The sectionalizer may be set to open on a permanent fault after one, two, or three operations of the recloser, as desired. Since the sectionalizer does not interrupt short circuit currents, contacts last indefinitely, and there is no carbonization of the oil.

HAS ALL THE **KYLE** SAFETY FEATURES

1
Tank, cover, and operating handle are dead. Tank may be grounded.

2
Mechanism cooled, and insulated from tank, by transformer oil.

3
Standard cover type bushings. Terminals are the only hot spots.

4
Trip-free operating handle.

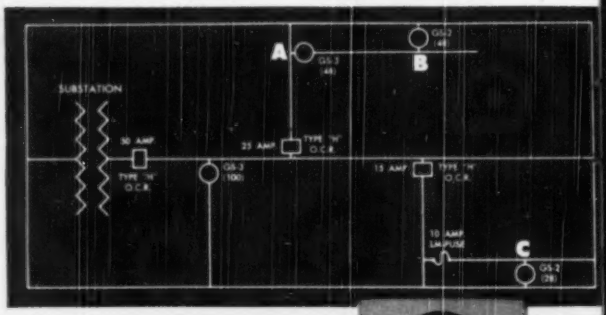
RATINGS:
Seven sizes, with minimum tripping current 8 to 100 amps to coordinate with reclosers rated from 3 to 50 amps; maximum operating current 150 to 1200 amps; 2400 to 15,000 volts. Ratings may be changed by changing coils in the field. Weight with oil about 20 pounds. Crossarm or direct pole mounting hangers.

Get the whole story!

For details, dimensions, ratings, mountings, and a complete description of how Kyle type GS Sectionalizers operate, ask the L-M Field Engineer for a copy of Bulletin CR3, or write Line Material Co., Milwaukee 1, Wisconsin (A McGraw Electric Company division).

To Protect Your Lines with Kyle Type GS Sectionalizers

The diagram shows how it is done: *Point A* shows a sectionalizer set to open on the third recloser operation, indicated by GS-3. *Point B:* further sectionalizing by setting the sectionalizer to open on the second operation of recloser—indicated by GS-2. *Result:* a permanent fault beyond *B* causes sectionalizer GS-2 to lock out after second recloser operation; service is maintained on the branch protected by sectionalizer GS-3 at *A*. *Point C:* Sectionalizer GS-2 set to open on second recloser operation isolates a permanent fault before the back-up fuses are damaged or blown by the third operation of the recloser. Kyle Sectionalizers also will replace branch line fuses on systems protected by Kyle Type H Reclosers, giving you complete automatic protection.



7130

LINE MATERIAL Kyle Sectionalizers

Complete Coordinated Equipment for All Distribution Requirements

KYLE OIL SWITCHES

for manual or remote control of

shunt capacitors, street lights, airport lighting, flood and other outdoor lighting, many other uses

100 AMPS., 15,000 VOLTS

Kyle manual (type G) and remote control (type GR) oil switches are sturdy, dependable, and provide many features that make them preferred for a wide variety of light duty load-break operations.

Quick break . . . long contact life

Both the manual and motor driven switches provide quick-break operation. Double copper-tungsten contact tips are specially designed to minimize burning and pitting, assuring long life.

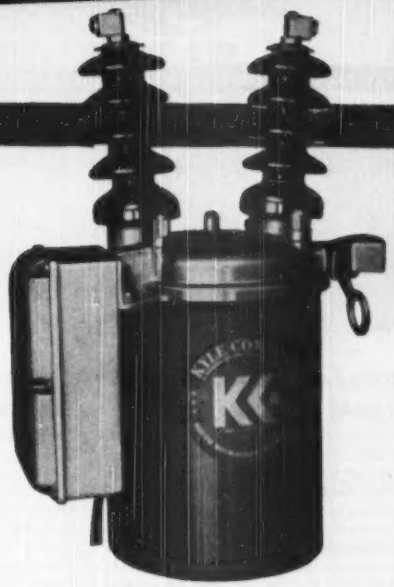
Both are light weight, easy to install, and their cost is moderate. They are safe to use. Mechanism is insulated from the tank. Head and operating handle are dead, the only live parts being the top bushing terminals.

Dependable Motor Drive

The type GR has a shaded pole motor with a 115 volt 60 cycle AC circuit with a selector switch to open and close the GR from a remote point. It may be operated manually if desired. The switch uses current only during the actual on or off operation. There are no magnets or coils requiring continuous current. Three single-phase type GR switches may be used to give simultaneous switching of three-phase circuits. Other than an annual oil change and inspection, these switches require no attention and give long, dependable operation within the recommended operating cycles.

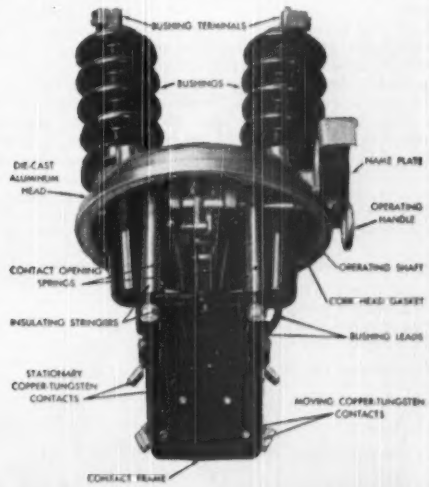
L-M'S COMPLETE OIL SWITCH LINE

Complete description, ratings, and dimensions in this handy Bulletin CR2. Ask the L-M Field Engineer for a copy or write Line Material Co., Milwaukee 1, Wisconsin (A McGraw Electric Company division).



Type GR Motor Driven Remote Control Switch

The manually operated type G looks the same except that it does not have the separately encased motor control mechanism shown on the left side. Total height, 18½"; tank 7⅛" diameter. Hangers for direct pole or cross-arm mounting.



7121

LINE MATERIAL Kyle Oil Switches

Complete Coordinated Equipment for All Distribution Requirements

WIRING NEWS

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT

Remote Control Promotes Increased Power Use

By making electrical control more convenient than ever before—General Electric remote-control wiring system now offers an effective tool for increasing power use in the home.

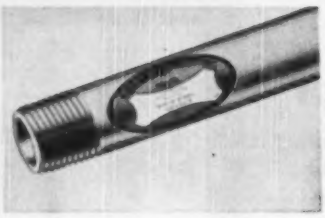
This new step-saving wiring system puts switches within easy reach—lets householders make full use of appliances and lights. Because it's interesting and brand-new, you'll find G-E remote control makes a good talking point for adequate wiring.

For Low-cost Homes

Designed to fit with existing wiring techniques, General Electric remote control is practical in new or old construction—even in budget-priced homes. It uses standard materials and methods on power circuits—simply substitutes an easily installed 24-volt circuit for the standard switching circuits.

You'll find General Electric remote control an effective door opener on many types of sales in both residential and industrial work. Don't overlook its possibilities for your customers and prospects. They're curious about this new system, and they're interested in the extra convenience it can offer.

For further information, see the remote-control display at your local General Electric distributor's, or check item (A) in the coupon below.



You Know You're Right With "G-E White"

There's no question about it. You get top wiring protection when you use General Electric white rigid conduit.

Carefully controlled in manufacture from raw material to final inspection, G-E White offers the advantages of a uniform, high-quality product. Top-quality steel, *hot-dipped - galvanized*, inside and outside, means years of protection from atmospheric corrosion. Smooth Glyptal® finish adds *plus* protection, makes wire pulling easy and fast.

During installation you'll appreciate the uniformity of G-E White. You'll like the way it cuts waste by eliminating flat bends. You'll like its sharp, clean threads.

For Chemical Corrosion

In locations where chemical corrosion threatens wiring installations, it will pay you to investigate the advantages of General Electric black rigid conduit. "G-E Black" is made from the same high-grade steel as "G-E White." It is treated with a special coating of tough black enamel—baked on at high temperatures—to protect wiring from corrosion by common corrosive chemicals as well as from harsh industrial atmospheres. Its hard, glossy-smooth finish makes wire pulling a snap and affords an excellent paint base.

For top protection on all your jobs, be sure to specify General Electric rigid steel conduit. For further information on either white or black conduit, check box (B) in coupon.

G-E Offers Complete Line Of Conduit Fittings

Did you know that General Electric has a complete line of conduit fittings and accessories? From the smallest sizes to the largest—you'll find a full range of types ready to do the kind of job you expect from products bearing the General Electric name.

You'll appreciate the convenience of shopping the General Electric way. On a single order, you can wrap up your requirements for conduit, accessories, and fittings—and you can be *sure* you're getting the best in each line.

If you'd like information on General Electric fittings or accessories check box (C) in the coupon.

Here's How You Can Add Greater Loads Without Changing Raceways

If you—or your customers—have a need for increasing power loads without adding to existing raceway facilities, here's a simple solution that can often work wonders. Using your present raceways, just replace Type R or RH wiring with General Electric Deltabeston® asbestos-varnished cambric cables.

Save on Space

For years, big power users have considered Deltabeston AVA the standard for small-diameter conductors on heavy-load jobs involving *high* temperatures. Now, more and more users are turning to G-E Deltabeston cables for extra savings where externally-caused heat is not a problem. At normal ambient temperatures (in dry locations as defined by the National Electrical Code) you can count on them to carry far greater loads than the usual types of building wires.

For Information

Why not find out for yourself how Deltabeston AVA cables can help solve your particular problem? For additional information, get in touch with your General Electric Construction Materials District Office—or check box (D) in the coupon.

Section K4-227
Construction Materials Department
General Electric Company
Bridgeport 2, Connecticut

Please send me free information on:

A ☐ Remote Control
B ☐ Conduit
C ☐ Conduit Fittings
D ☐ AVA Cables

Name _____ Title _____
Company _____
Address _____
City _____ Zone _____ State _____

GENERAL ELECTRIC

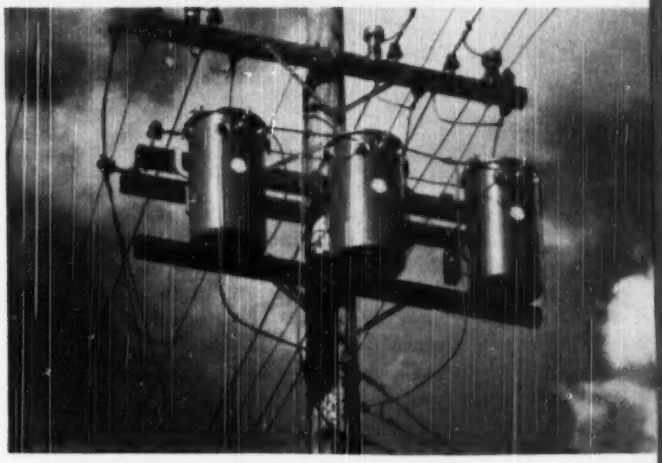
Here is real news . . . ***Pennsylvania***

POLE STAR TRANSFORMERS

Now available in sizes up to 100 Kva

When you must increase the size of your transformer bank because of additional load, replace conventional stacked core transformers with wound core Pole Star Transformers of larger ratings.

This can be done in many cases without changing the pole construction because the new Pole Star Transformers are lighter in weight and smaller in dimensions than their stacked core predecessors. When transformers are hanger-mounted in banks of three units, very often they can be replaced with larger Pole Star Transformers for **hanger-mounting on the same pole**—thus eliminating the need for costly platform mounting, or for replacing existing poles with heavier poles. This is especially true of the 75 Kva Pole Star Transformer which actually weighs less than Pennsylvania's former stacked core 37½ Kva transformer. 100 Kva Pole Stars weigh less than the old 75 Kva's . . . . . and so on down the line.



Write to Pennsylvania Transformer Company, Box 330, Canonsburg, Pennsylvania, for Pole Star Catalog No. 1049.

here is the meaning of the news . . .

WHEN YOUR LOAD CALLS FOR 75'S BUT YOUR LINE POLES ARE DESIGNED FOR MOUNTING CONVENTIONAL STACKED CORE 37½'S — DON'T GO TO THE EXPENSE OF COSTLY PLATFORM MOUNTING — REPLACE THE 37½'S WITH 75 KVA POLE STARS *on*

the same line poles

Cutaway of 75 Kva Pole Star Transformer

Pennsylvania

TRANSFORMER COMPANY

Canonsburg, Pennsylvania — Greater Pittsburgh District

THE PROOF *is in the service records!*

There is no better proof of the superiority of Amcreco Poles, Cross Arms and Conduit than the actual service records. It is the best indication of the long pole life and freedom from maintenance troubles for users of Amcreco. We will be pleased to show you typical service records and point out how Amcreco can reduce your cost per pole per year. Write today.

Amcreco
Lowry Process
Creosoted Products

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY
GEORGIA CREOSOTING COMPANY
LOUISVILLE, KENTUCKY

POLES • CROSS ARMS • CONDUIT

Central National Bank, Chicago, Illinois
Architects: Graham, Anderson, Probst, White
Fixture Manufacturer: Morris Kurtzon, Inc.
Electrical Contractor: Hulgren Electric Co.
Glass: CORNING ALBA-LITE

Your most adaptable fluorescent lighting medium . . .

Corning "ALBA-LITE"

This photograph gives you an idea of how well CORNING ALBA-LITE diffuses fluorescent light . . . especially desirable for office work. The qualities of diffusion and brightness control are contained within a thin opal glass panel. This makes ALBA-LITE adaptable to almost any type of installation whether recessed or exposed.

There is no limit to the design flexibility that can be achieved with ALBA-LITE. It is obtainable flat or bent in four standard patterns as shown.

Widths vary from 2" to 24", lengths from 8" to 100". It may be used in fixtures, or glass ceilings, as required.

Bulletin LS-17 describes this versatile lighting glassware in detail and illustrates many ways it is being used. This new 30 page bulletin is yours for the asking. Use coupon below.

PYREX

CORNING GLASS WORKS
CORNING, NEW YORK
Corning means research in Glass

FOR EFFICIENT, ATTRACTIVE LIGHTING . . .
CORNING ALBA-LITE for diffusion of fluorescent light . . . CORNING FOTA-LITE for high level illumination . . . CORNING brand LENS PANELS and PYREX brand LENSLITES for prismatic light control

CORNING GLASS WORKS
Dept. AR-2, Corning, N. Y.

Please send me a free copy of your bulletin LS-17 describing CORNING ALBA-LITE.

Name_____
Firm_____
Address_____
City_____ Zone_____ State_____

FWD *Announces a*

LIGHT-DUTY

FOUR WHEEL DRIVE

Created for an Entirely New FWD work-range··In Answer to Demand

One of the most important developments in 40 years of FWD leadership! Here is a completely new Four Wheel Drive . . . designed to broaden the range of operation in the light-duty truck field. Now you can have a *true* Four Wheel Drive to completely fill the needs which *conversions* and conventional trucks have sought to answer. This new model — the LD — fulfills countless requests for an FWD in that broad field.

GET ALL THE FACTS on the LD! Ask for this folder, "The Story of the LD". See your FWD distributor or write FWD.

THE FOUR WHEEL DRIVE AUTO CO.
CLINTONVILLE, WIS.
Canadian Factory: Kitchener, Ont.
World-Wide Sales and Service

Built by the Makers of America's Foremost Heavy-Duty Trucks

Exide-Manchex batteries

assure positive operation of switchgear

Exide-Manchex Batteries are different. Their famous Exide manchester positive plates are unique in design and construction, and are used *exclusively* in this outstanding storage battery. Other important features include: slotted plastic separators, impervious to chemical and electrical reaction; plastic spacers that maintain perfect plate alignment; the latest development in molded glass jars; heavy terminal posts with copper insert for extra conductivity. Combined, these features assure dependable power for positive operation of switchgear.

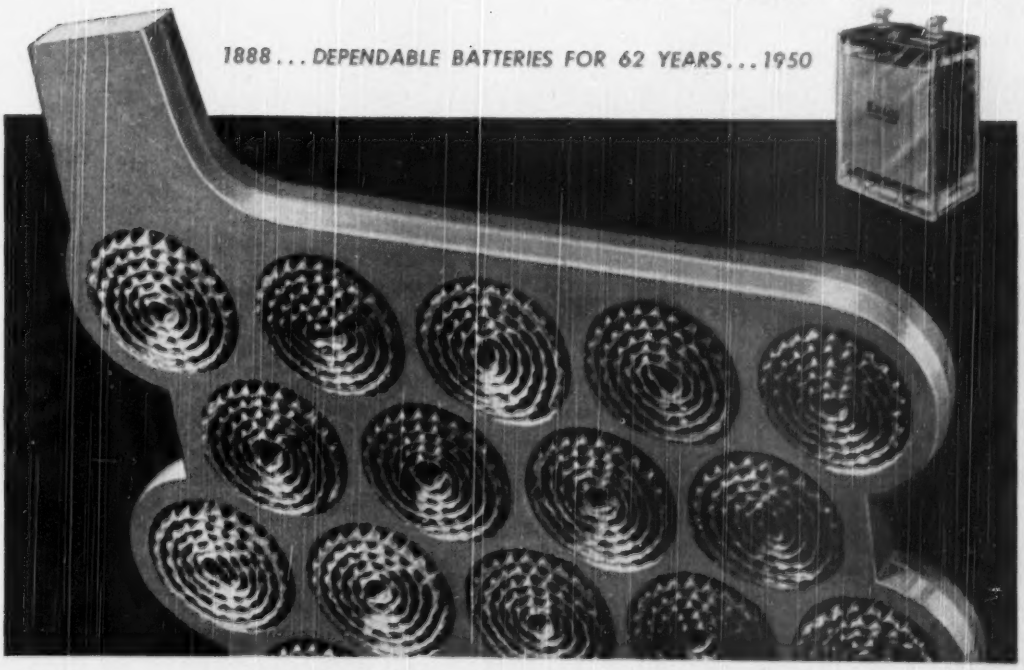
With Exide-Manchex Batteries, you get assurance of an adequate and uninterrupted supply of current for central and sub-station services. And you can also count on Exide-Manchex Batteries for maximum dependability, long life and low cost maintenance.

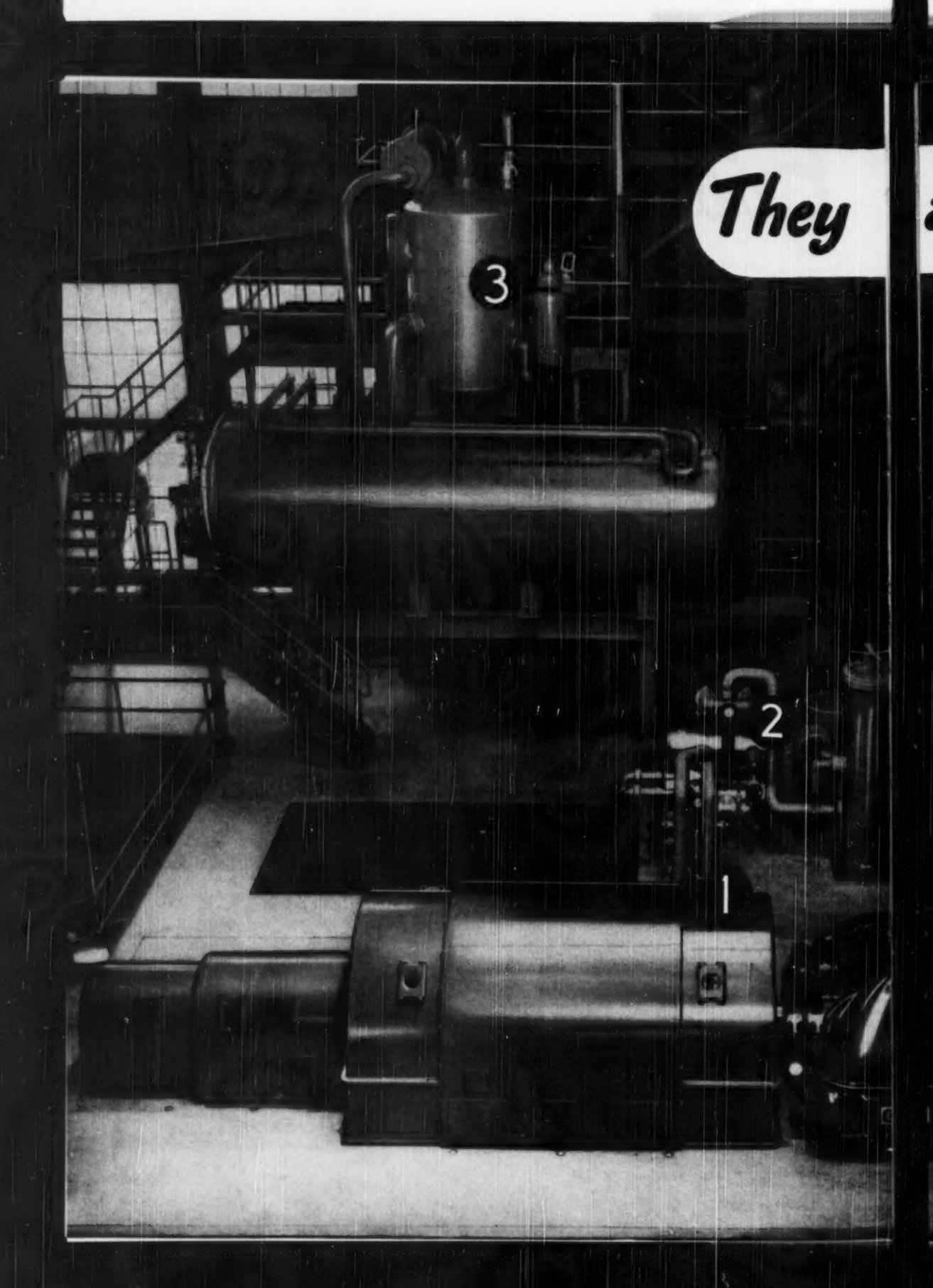
THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

"Exide-Manchex" *Reg. Trade-mark U. S. Pat. Off.*

1888 . . . DEPENDABLE BATTERIES FOR 62 YEARS . . . 1950




They
3
2
1

all bear the same name-plate

ELLIOTT

❶ In the foreground, an Elliott turbine-generator unit — clean-lined, businesslike, and all-Elliott throughout . . .

❷ Just back of the turbine-generator, an Elliott twin two-stage steam jet ejector which serves the Elliott surface condenser under the main turbine . . .

❸ In the background, the Elliott vertical deaerating feedwater heater mounted on its horizontal storage tanks, unsleeping sentinel against corrosive elements in the boiler feedwater . . .

And not shown in the photo, but definitely in the picture of operating economy, is an Elliott evaporator preheater quietly and faithfully performing its function.

This plant, generating at 13.8 kv, with 600 psi, 825 F steam conditions, is typical of a score of utility installations where Elliott equipment has gone into service recently.

Here is team-work at its best. You'll find it wherever Elliott equipment gets together.

Complete data on any of this equipment mailed at your request.

ELLIOTT COMPANY

Plants at: JEANNETTE, PA. • RIDGWAY, PA.
AMPERE, N. J. • SPRINGFIELD, O. • NEWARK, N. J.

DISTRICT OFFICES IN PRINCIPAL CITIES

G-1148a

oil resistance

chemical resistance

high stability

bakes clear through

low cost

Combines all 5

NEW IRVINGTON #1100 CLEAR INSULATING VARNISH

Now—just one varnish is all you need for practically all windings. And just one coating normally is enough, when it's a coating of Clear Irvington #1100.

This new insulating varnish penetrates to the deepest coil layers, adhering firmly to the wires, and bonding all into a solid mass. The coating produced is tough, oil-proof and lasting. An internal-curing varnish, it hardens clear through after quick baking. The solvent used—V. M. & P. naphtha—will not attack magnet wire coatings. Both shelf stability and dip tank stability are good.

Irvington #1100 is the latest product of Irvington laboratories. It was developed after extensive research to provide a single varnish for use on all windings except those operating at highest peripheral speeds . . . a top-quality varnish at a moderate price. Standardize on Irvington #1100 and you'll cut your varnish inventory and costs. Samples on request.

Specifications:

Dry Dielectric	2000 VPM
Moisture Resistance	Good
Oil Resistance	Excellent
Acid Resistance	Excellent
Alkali Resistance	Good
Heat Resistance	Very Good
Penetration	Excellent
Baume	25° @ 30 deg. C.
Sp. Gr.	0.903 @ 30 deg. C.
Sp. Gr. for use	Optional
Solvent	V. M. & P. Naphtha

IRVINGTON

Varnish & Insulator Co.

Irvington 11, New Jersey

module lights a bank

...and demonstrates its remarkable efficiency by maintaining a lighting level of 60 footcandles in the lofty and spacious banking room illustrated. . . .

Mr. Alex Salvatori, President,
Peoples Federal Savings and Loan Assn., Wheeling, West Virginia; Director Federal Home Loan Bank (Dist. No. 3) Pittsburgh; past president, West Virginia Savings and Loan League

"we wanted the very latest and finest in everything, including lighting . . . *we chose* Mitchell module"

It takes more than "just another fixture" to sell a bank president! Mr. Alex Salvatori, head of Wheeling's Peoples Federal Savings and Loan Association, says: "When we decided many months ago to buy our new building and go into a complete modernization program, we were sure of one thing—we wanted the very latest and finest in everything, including lighting. We chose Mitchell MODULE, and I am very happy today that we made this decision. The lighting effect in our banking room has brought forth a remarkable amount of favorable comment, and we ourselves are most highly pleased with the job."

Mitchell MODULE delivers *20% more light*, fits *any* architectural interior, provides *custom appearance* in unlimited pattern arrangements—at no more than the cost of ordinary fixtures. For *any* commercial installation—whether it calls for one unit or a hundred—specify MODULE and deliver the greatest development in lighting since the fluorescent lamp. Write today for the full details.

these 4 low-cost modules are the "building blocks" of a perfect custom-fitting lighting installation

D 4 75-Watt T-12 425 Milliamp Slimline Lamps

C 4 40-Watt T-12 48" Type F Lamps

B 32-Watt 12" Circline Lamp, and 1 PAR Spot or Flood Lamp

A 4 14-Watt T-12 15" Type F Lamps

modules fit together perfectly end to side, end to end, side to side... to form more than 50,000 different lighting patterns...to fit any ceiling shape or size...mixing all light sources in one harmonious system... with equal brightness throughout (no dark sides or ends)...so you can put the light where it is needed!

MITCHELL **module**

REG. U.S. PAT. OFFICE

Only MITCHELL makes MODULE

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Illinois

Send free 20-page brochure describing MODULE.

Firm Name_____

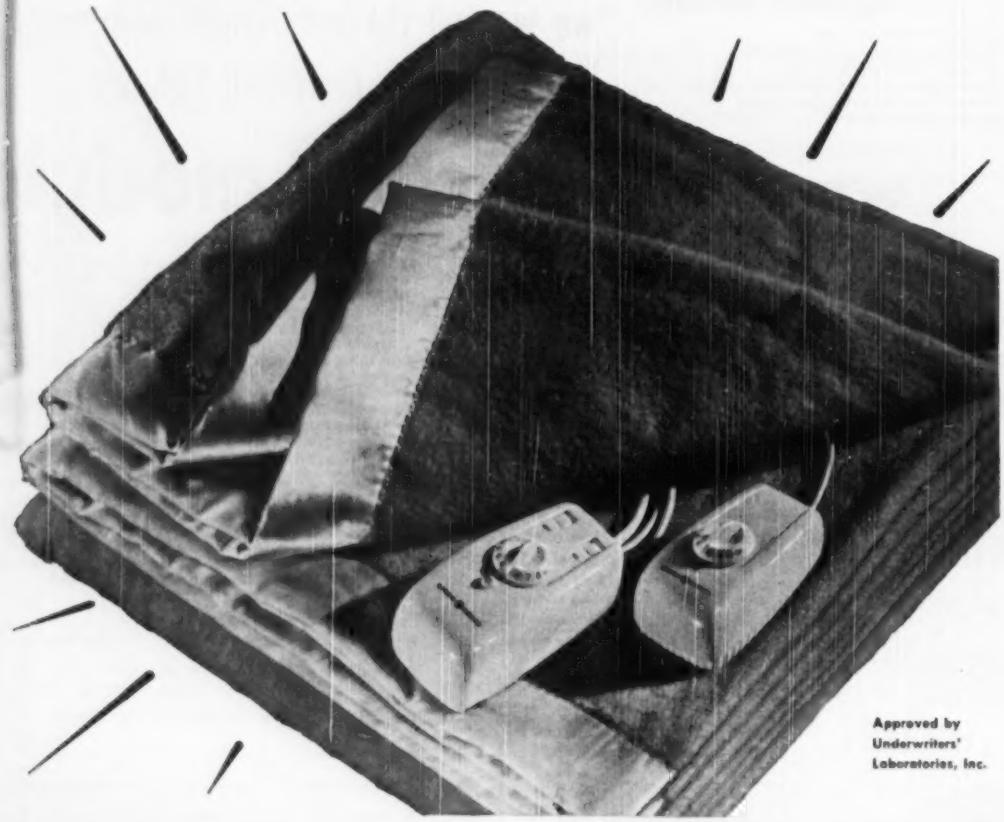
Address_____

City_____ Zone____ State_____

Attention:_____

Now—over 1,000,000 Automatic Blankets add

When the lights go off, this appliance goes on to increase your slack-time load $5,000,000 annually. *Read on*, and see how you can build your midnight-to-morning revenue still higher . . .



Approved by Underwriters' Laboratories, Inc.

General Electric

to your off-peak revenue!

One General Electric Automatic Blanket uses 96 kilowatts annually . . . creating approximately $5 of plus revenue (national averages). Two blankets approximate the load of one six-foot refrigerator.

Over 1,000,000 General Electric Automatic Blankets (representing $5,000,000 off-peak revenue to you each year) are now in use, and more and more are being sold each week—especially with three months of peak blanket-buying ahead!

To help these sales rise to new highs, General Electric will launch a truly impressive national advertising campaign for Automatic Blankets in 1950. This program includes full-page, full-color ads to capitalize on the Fall and Winter blanket-buying season.

What's more, you can help this sales trend by taking advantage of the new General Electric co-operative advertising program. It offers you an opportunity to participate on a 75%-25% payment basis in local newspaper and radio advertising.

Be sure to get the wonderful new Utility Brochure which includes advertising and promotion ideas, car cards, bill stuffers, and imprinted envelopes.

For this and other sales-helps (listed below), write your local Blanket Distributor or Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Connecticut.

The following items will assist you in presentations, advertising campaigns, mailings, and sales!

1. **Specification sheets on the de luxe and new standard blanket lines.**
2. **Six-page envelope stuffer.**
3. **Single-sheet envelope stuffer.**
4. **Color cards.**
5. **Testimonial booklets.**
6. **Newspaper ad mat book.**
7. **"Tell Your Customers" fact cards.**
8. **Blanket Utility Brochure.**
9. **New Automatic Blanket Wire Rack Display—which holds three standard or de luxe blankets.**

AUTOMATIC BLANKETS

"Go to work when the lights go out!"

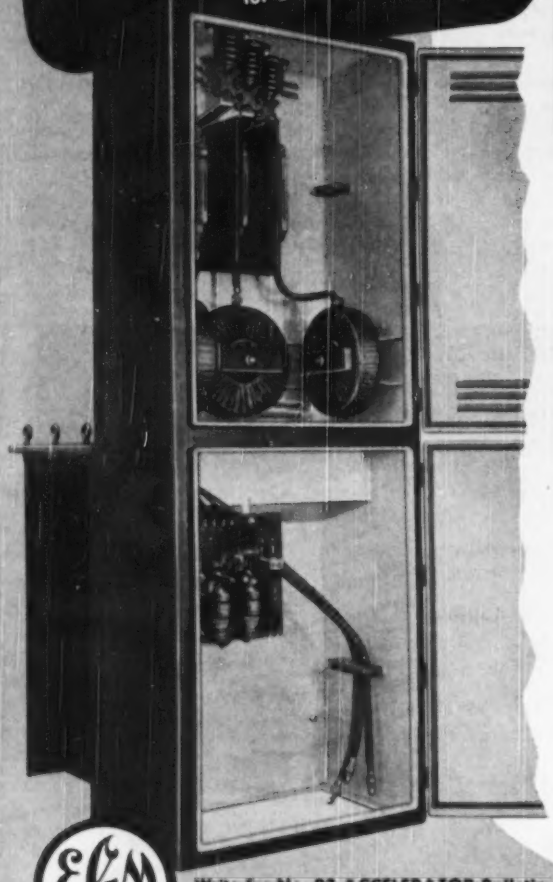
GENERAL ELECTRIC

Cost Cutting Facts

about

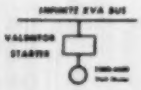
EC&M VALIMITOR Starters

for 2300-4600 Volt Motors



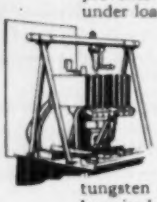
COST FEATURES

One initial cost (stand-by fuses not required). *Nothing* to replace (no fuses to blow). *No change* later on (increase in available KVA does not require redesign of starter).



PROTECTIVE FEATURES

Safe for connection to a bus of *any* capacity. *Magnetic* Overload relays have combined *instantaneous-trip* and *inverse-time-element trip* features. *Completely* enclosed, shock-proof starter construction. *Door-interlock* prevents opening disconnect switches under load.



DESIGN FEATURES

Double-break opening in each line by heavy-duty contactor having copper-tungsten contacts. *Contactor* may be raised to accessible position at top of tank without disconnecting any bolts or leads. *Unit construction* reduces installation time and material. *Low-voltage push button* circuit—from self-contained potential transformer.

OPERATING FEATURES

Cushioned Starting at no extra cost—when motor is up to speed, these starters function like any standard full-voltage starter. *Valimitor Starters* have high thermal capacity to withstand frequent starting—their heat inertia is equal to or greater than that of the average motor. *Valimitor Starters* may be used with high inrush motors. *Low up-keep costs*—the well-known ZHS Contactor has a reputation for dependability—long contact life and infrequent inspection.

PURCHASING SIMPLICITY

No need to calculate existing KVA. *No worry* about estimating future possible growth. *Order by* horsepower size, voltage, and frequency.

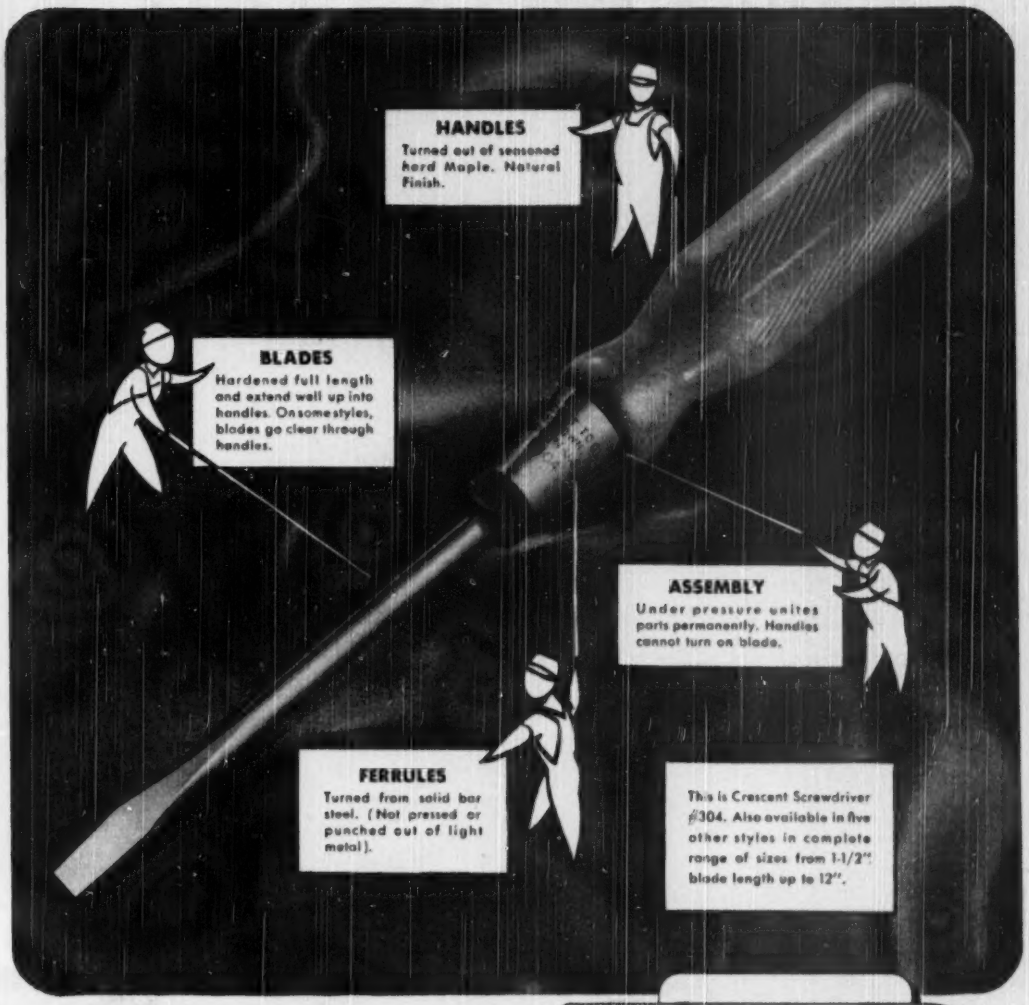
Before buying 2300-4600 volt motor control—investigate EC&M VALIMITOR Starters.

Write for No. 23 ACCELERATOR Bulletin.

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79TH STREET ★ CLEVELAND 4, OHIO

CRAFTSMEN RECOGNIZE QUALITY *by these fine features in a* SCREWDRIVER


HANDLES
Turned out of seasoned hard Maple. Natural Finish.
BLADES
Hardened full length and extend well up into handles. On some styles, blades go clear through handles.
ASSEMBLY
Under pressure unites parts permanently. Handles cannot turn on blade.
FERRULES
Turned from solid bar steel. (Not pressed or punched out of light metal).
This is Crescent Screwdriver #304. Also available in five other styles in complete range of sizes from 1-1/2" blade length up to 12".

EVERYBODY RECOGNIZES QUALITY *by this Trade-mark*

CRESCENT TOOLS

Sign of the Artisan Symbol of Excellence

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

How Allis-Chalmers Solved Transformer

ALLIS-

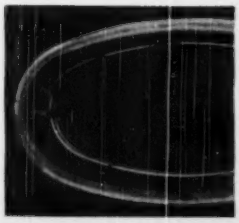
Pioneers in Load Ratio

PROBLEM:

To carry away heat losses of one 750 kva and two 2000 kva transformers from a basement in which adequate ventilation did not exist. There was no other possible location. The cost of adequately ventilating the basement would be prohibitive.

SOLUTION:

Water-cooling for transformers recommended . . . a method commonly used to cool large transformers in hydro-electric plants. *Chlorextol* liquid transfers heat from windings to water tubes located inside transformer tank. Water carries heat away.



Experience Heat Loss Problem!

NUMBER [illegible] IN A SERIES
Solving Industrial Power Distribution Problems

ALLIS-CHALMERS LOAD CENTER UNIT SUBSTATIONS

A PROMINENT MIDWEST MANUFACTURER had this problem: How to locate unit substations — one rated 4000 kva, the other 750 kva —right at load centers, in a basement where ventilation was inadequate to remove transformer heat losses by the usual radiator-to-air method.

Allis-Chalmers, called in on the job, recommended and built *water-cooled* load center transformers. Although commonly used on large, high-voltage power transformers, water-cooling as applied to load center transformers was considered very unusual. Yet, in this case, the arrangement proved completely satisfactory — so satisfactory that when additional substations were required, Allis-Chalmers LCS unit-subs with water-cooled transformers were specified! Thus, what had started out as a solution to an emergency situation became a design specification for this firm.

CALL IN ALLIS-CHALMERS UNIT-SUBSTATION EXPERTS AT THE BASIC PLANNING STAGE

The experience of this manufacturer illustrates how Allis-Chalmers Unit-Substation engineering can serve *you!* And the time to call on this experience is during basic planning, early enough for sound equipment recommendations. An A-C representative is ready to go into detail with you at your convenience. Call your nearby A-C Sales Office, or write direct. A-2914

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

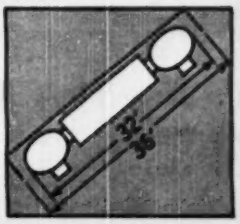
Chlorextol is an Allis-Chalmers trademark.

CHALMERS A-C ALLIS-CHALMERS

Control — Originators of 5/8% Step Regulation

TIGHT SQUEEZE!

Furthermore, the 4000 kva double ended substation had to fit between pillars only 36 ft apart. Note how selector switches were placed on *front* of transformers, making the necessary space-saving possible . . . a second problem solved by A-C!



SEND FOR HELPFUL AIDS

Bulletin 11B6285A, "How Power at Load Centers Pays Off!";
Bulletin 11B6325B, "Check List to Simplify Unit Substation Planning";
Bulletin 11B6895, "Planning and Engineering Guidebook for LCS Unit Substations".

K&M ASBESTOS TEXTILES
From asbestos we produce yarn, thread, cord, braided tubing, woven tapes and cloth for the electrical industry. They all meet ASTM standards. We manufacture them all in the only way K&M knows—with utmost care—uniform to such a degree that you find these products able to facilitate your production and guard the performance of your finished products.
K&M has over 50 years of knowledge and experience in this field, to focus on any problem of yours where an asbestos textile can better your product. Consult us.

Nature made Asbestos . . .

Keasbey & Mattison has made it serve mankind since 1873

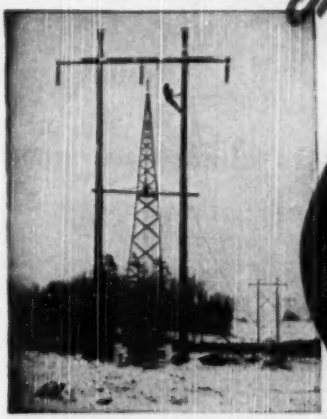
KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

In Canada—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

Your PORCELAIN PRODUCTS' Suspension Insulator...

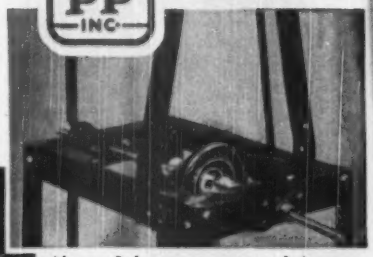
the best Power Salesman on Your Payroll

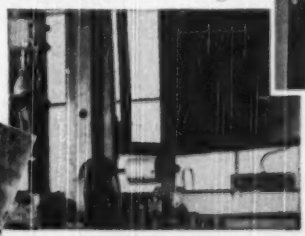


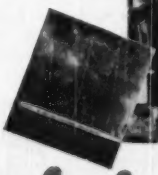
You sell power when your lines stay up. One "weak link" in your insulator chain can black out whole communities, resulting in unsatisfactory customer relationships, the cost of which cannot be computed, in addition to the cost of repairs and the loss of revenue. PORCELAIN PRODUCTS' Suspension Insulators keep selling for you because they give continuous, trouble-free performance. They're compression glazed for added toughness, and designed to withstand unusual strain of wind and ice loads. Built to rigid manufacturing standards, like those illustrated, assure perfect performance in service. Next power job, specify PORCELAIN PRODUCTS, and see what a "power salesman" you've hired. For other PORCELAIN PRODUCTS' High Voltage Insulators and accessories—

PINTYPES, CUTOUTS SPOOLS, STRAINS, CLEVISES, RACKS, WIREHOLDERS

Write for Your Copy of Catalog 10-A







Above—Laboratory measured impact tests verify the fact that your P.P. Suspension Insulators can *"take it"*.

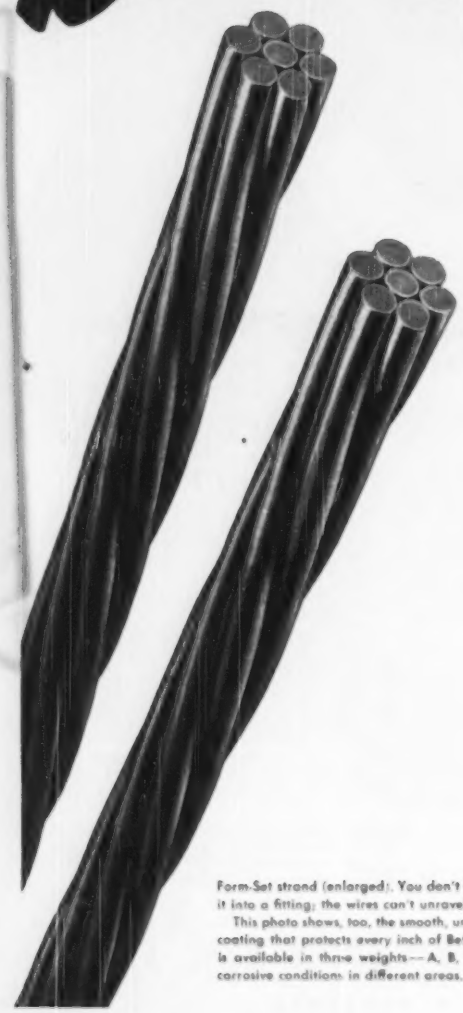
Left—C—Combined mechanical electrical strength test proves the stamina of Porcelain Products Suspension Insulators.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

One of today's BIGGEST "BUYS"

Form-Set strand costs almost no more than the non-preformed type. Its extra features are yours for practically nothing



Form-Set strand (enlarged). You don't have to "wrestle" it into a fitting; the wires can't unravel.

This photo shows, too, the smooth, uniform bethanized coating that protects every inch of Bethlehem strand. It is available in three weights—A, B, and C—to meet corrosive conditions in different areas.

Many prospective buyers express surprise when we tell them how *little* extra Form-Set strand will cost them. Form-Set is Bethlehem's preformed strand, which has many advantages over the conventional non-preformed type. You'd expect to pay considerably more for it. But you don't.

Ever used it? If not, let us tell you what some of those advantages are. Form-Set has no inner tension or wildness. The illustration shows what a cut section looks like. Notice there isn't any seizing—yet not a single wire is out of place.

Naturally, this means that Form-Set is easier to handle in the field . . . much easier to insert in fittings. Saves time, saves tempers. Gives a better job. The preformed construction is especially valuable in the high-strength and extra-high-strength grades.

A Bethlehem man would like the privilege of telling you about it. He knows it's good and can recommend it conscientiously. Why not call him in?

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

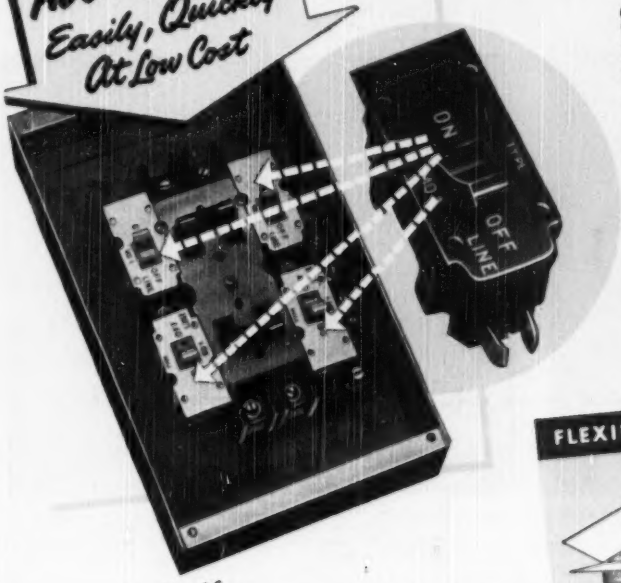
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

"Ad-On" MULTI-BREAKER

TYPE MO-3 SERVICE AND LOAD CENTER

ADD CIRCUITS
Easily, Quickly
At Low Cost



START WITH 4:

Basic circuit breaker unit provides 4 single pole, 1 double pole and 2 single pole, or 2 double pole circuits in combinations of 15, 20, 30, 40 or 50 ampere ratings.

ADD 4 MORE:

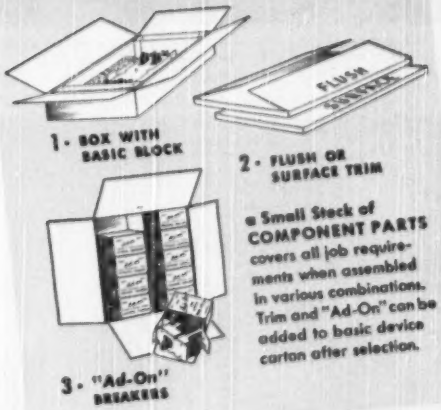
1, 2, 3, or 4 single pole circuit breaker units rated 15, 20 or 30 amperes are easily plugged in on basic block.

Coilless Thermal Magnetic Multi-breaker

The basic **"Ad-On"** Multi-breaker unit provides four circuits—the *minimum* for a modern home. Even more important, it provides for easy addition of circuits *as they are needed*. Four off-the-shelf **"Ad-On"** breakers extend the range of the basic block in the required circuit pattern.

Architects, builders and contractors all know from experience that many electrical appliances are added after homes have been completed and lived in. With **"Ad-On"** breakers it's a simple matter to provide these circuits so necessary for better electrical living.

FLEXIBLE MERCHANDISING PLAN



1 - BOX WITH BASIC BLOCK

2 - FLUSH OR SURFACE TRIM

3 - **"Ad-On"** BREAKERS

a Small Stock of **COMPONENT PARTS** covers all job requirements when assembled in various combinations. Trim and "Ad-On" can be added to basic device carton after selection.

ASK Your Square D Electrical Wholesaler to Show You the "Ad-On"

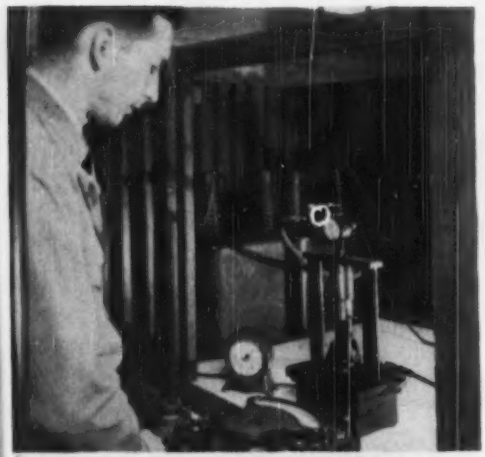
SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

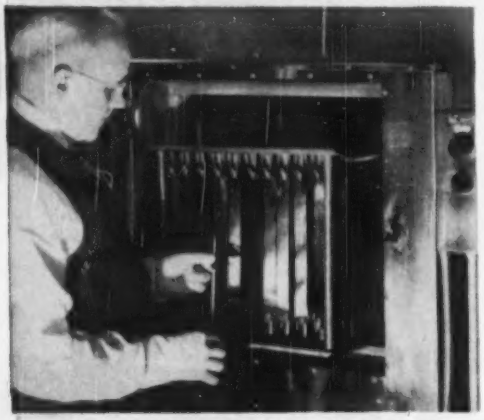
If you need

but are cramped for space



Samples from each lot are tested for dielectric strength and are required to withstand 1000 volts per mil at room temperature.

Hot oil test. Varnished cambric is subjected to a severe heating test—hot petroleum at 150°C. for a period of 15 minutes. After cooling the varnished coating must not be softer nor more tacky than before immersion.



Precisely controlled ovens subject varnished cambric to aging tests far in excess of normal requirements.

The cambric tape is critically examined for gauge, thread count and tearing strength. Tensile strength lengthwise must not be less than 3000 psi.

more power

—use American Varnished Cambric Cables

Maximum power, minimum size, lower costs and ease of installation—these are the chief advantages of U·S·S American Varnished Cambric Cables.

● How to get the most power from the smallest cable is a problem continually being faced by electrical engineers. The improved varnished cambric wires and cables offer a happy solution in many cases.

The varnished cambric used by American Steel & Wire Company is being recommended for operating temperatures up to 85°C. (185°F.). In this respect it is notably superior to rubber . . . permits greater current carrying capacity. It also has higher dielectric strength which results in cables of smaller outside diameter. In multiple conductor cables, part of the insulation may be applied in the form of a belt, thus reducing outside diameter still further. These features permit varnished cambric cables to carry substantially more power for their size than rubber insulated cables.

The fact that oil and grease do not damage varnished cambric insulation makes it widely used for motor and generator leads, transformers, regulators and oil circuit breakers. It is particularly desirable for heavy power lines in power plants, factories and mills.

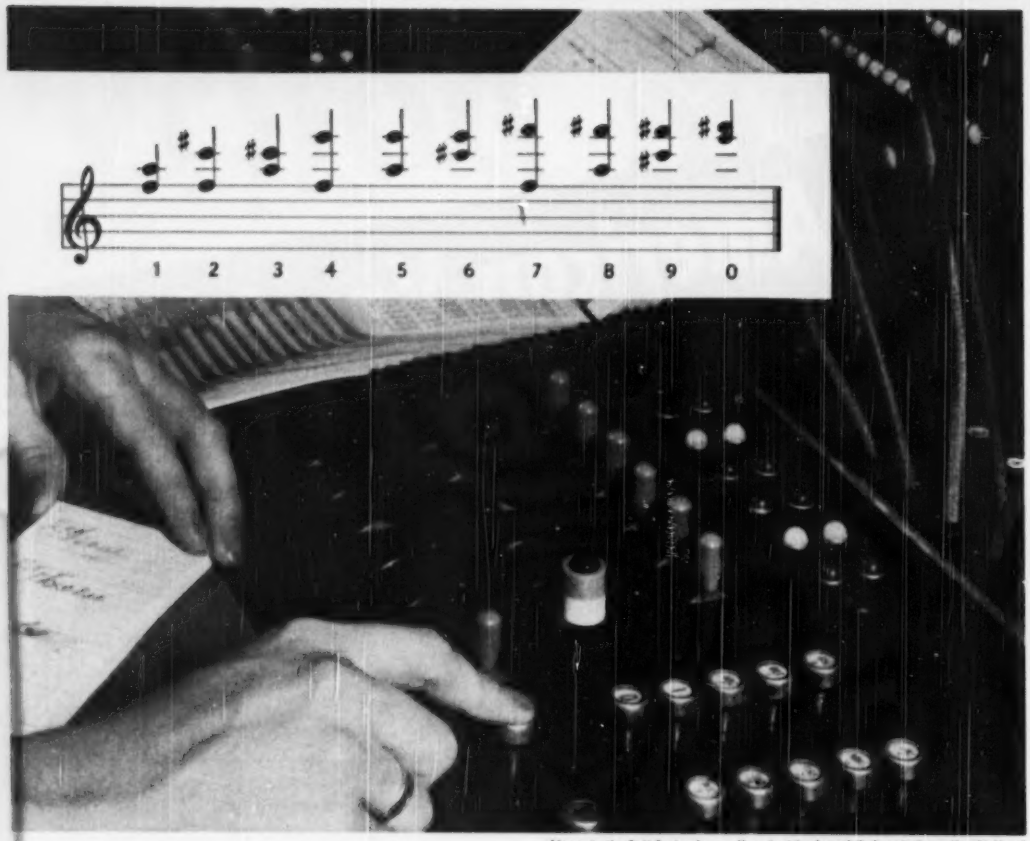
With the protection of a lead sheath, (Type PS Strand Shielding used over 2KV) varnished cambric can be used where continuous exposure to moisture is expected. Combined with asbestos insulation, it can be used for extremely hot locations.

For complete information on the many types of U·S·S American Varnished Cambric Cables, write for our technical booklet.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS American Varnished Cambric Wire and Cable

UNITED STATES STEEL



Above is the Bell System's new "musical keyboard." Insert shows the digits of telephone numbers in musical notation, just as they are sent across country.

Playing a tune for a telephone number

Before you talk over some of the new Bell System long distance circuits, your operator presses keys like those shown above, one for each digit in the number of the telephone you are calling. Each key sends out a pair of tones, literally setting the number to music.

In the community you are calling, these tones activate the dial telephone system, to give you the number you want. It is as though the operator reached clear across the country and dialed the number for you.

This system, one of the newest developments of Bell Telephone Laboratories, is already in use on hundreds of long distance lines radiating from Chicago, Cleveland, New York, Oakland and Philadelphia, and between a number of other communities.

It will be extended steadily in other parts of the country – a growing example of the way Bell Telephone Laboratories are ever finding new ways to give you better, faster telephone service.

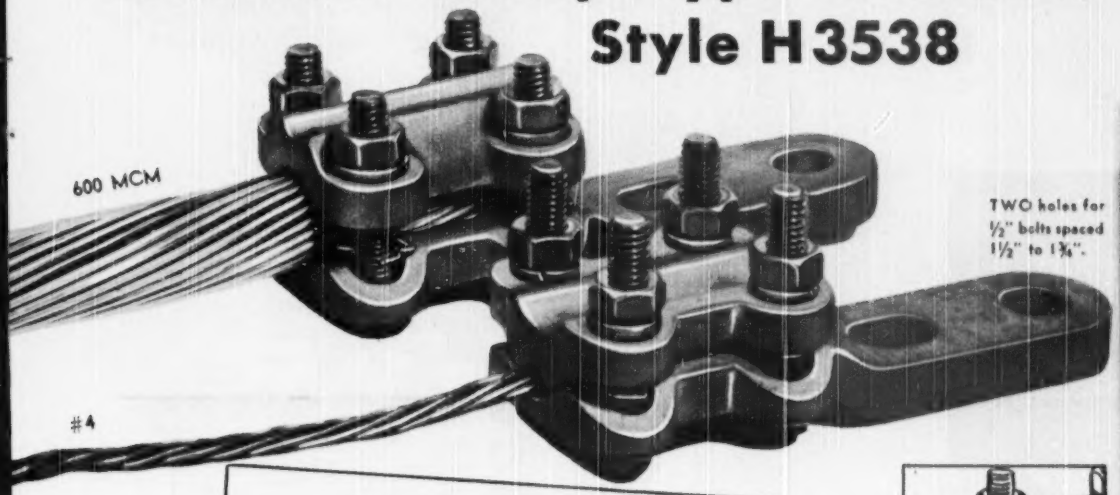
BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service

Pacific Electric

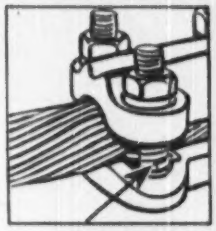
Really Simplifies Your Inventory with

Universal-Clamp-Type Terminal Style H3538



Style H3538 Terminal

Accommodates stranded copper wire #4 to 600 inclusive and #2 to 4/0 solid



Exclusive Wire Clip
(Patent Applied For)

Prevents bolt from dropping out when nut is removed.

Order Style H3538 Terminal to Simplify Your Inventory

Call PACIFIC ELECTRIC MFG. CORPORATION

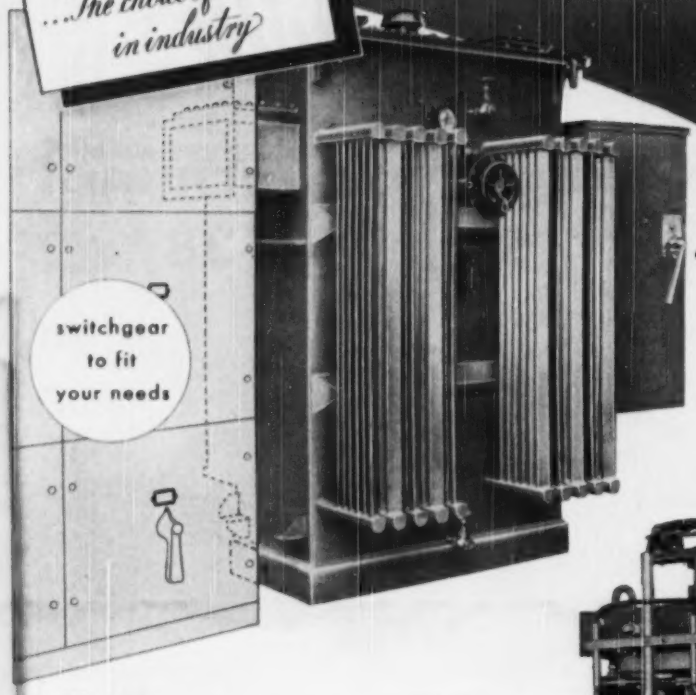
Other Representatives in Principal Cities

WAGNER TRANSFORMERS
...The choice of leaders in industry

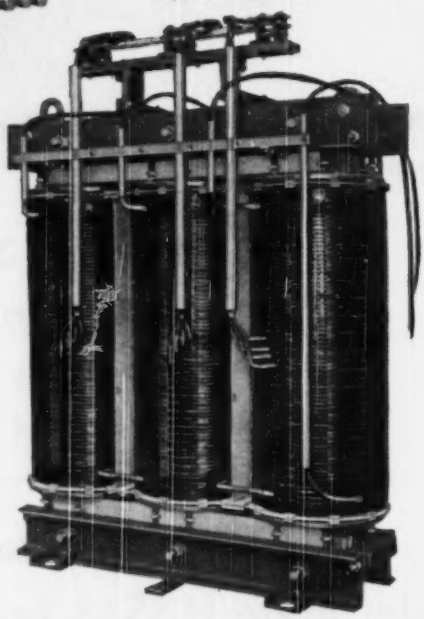
Wagner Unit Substation Transformers

designed to meet your distribution requirements

switchgear to fit your needs



Core and coil assemblies of Wagner unit substation transformers are designed by experienced engineers, and built and tested by skilled workers. Highest quality materials are used throughout, and meticulous attention to detail marks each step in their construction.



The transformer is the vital part of a load center distribution system. If the transformer fails, the entire system is dead whereas only part of the distribution system is affected by the failure of a switch or circuit breaker.

You can be sure of a dependable continuous flow of power from a Wagner transformer and you can be sure that it has been carefully designed to meet your distribution requirements.

Wagner unit substation transformers with incoming high voltage switch sections to meet your requirements, and with proper throats on the secondary side to connect to any make of switchgear, are available in the usual range of ratings up to 2000 kva. Our factory-trained sales engineers are well qualified to recommend the various combinations necessary to handle your unit substation requirements and they will be glad to give you immediate service.

Wagner unit substation transformers have been installed in all kinds of industrial plants including synthetic rubber, petroleum, steel, chemical, aircraft, automotive, paper, and many others. The importance of the transformer in a unit substation justifies calling in the Wagner sales engineer to help solve your load center problems.

Bulletins TU-13 and TU-56 describe the design and construction features that make Wagner liquid-filled and dry-type unit substation transformers outstanding.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES IN 29 PRINCIPAL CITIES

DRAVO CORPORATION

POWER DEPARTMENT

Let us be your Construction Department

ENGINEERING CONSTRUCTORS

DUQUESNE LIGHT COMPANY'S Frank R. Phillips Power Station at Wireton, Pa. Units 2 and 3, now being constructed by Dravo, will more than triple the original 75,000 kw capacity of this key station serving the Pittsburgh area.

DRAVO

CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

DRAVO

Engineering Constructors of power plants, process plants, ore preparation plants, pumping stations, fabricators and erectors of power piping, power boilers, pressure vessels

PITTSBURGH • PHILADELPHIA • CLEVELAND • NEW YORK • DETR

1950 . . .
Our Industrial Machine Is Running Down

In his recent Economic Report to Congress President Truman chalked up a constructive advance in his economic reasoning. He pointed out that if we are going to attain the worth-while goal of a $300 billion national income in the next five years, we must equip ourselves with more and better industrial tools. Of all the dynamic forces of expansion in America, he said, one of the most important is business investment.

That is fine. It is basic common sense. We have been saying that for years and we are glad to hear the President say it too.

But having hit this new high in his economic reasoning, the President failed to draw the right conclusion. He made the mistake of accepting the false conclusion that there is no shortage of business funds to pay for more and better industrial tools. "There are immense opportunities for business investment in nearly every segment of the economy," the President said, and further, "there are in general sufficient funds available to businessmen who want to seize these opportunities."

That just is not so – and the lack is not only serious; it can well be fatal.

It is a matter of the most urgent national importance that the President's recognition of the need of more and better industrial tools should be followed by effective action. *That calls for changes in the national policies that are now blocking and, unless changed, will increasingly block business from meeting this need. If business cannot get enough new tools, the result will not be higher, but lower standards of living five years from now.*

The President should talk this matter of business investment over with Senator O'Mahoney, the Chairman of the Joint Congressional Committee on the Economic Report. Senator O'Mahoney would take to the discussion knowledge of the investment situation recently acquired through his conduct of a series of Congressional hearings.

If he told the President what he told the press during the course of these hearings, he would say, "the private capitalistic system is being seriously threatened by a lack of venture capital." That is in direct conflict with the President's conclusion that "there are in general sufficient funds available."

This serious shortage of adequate investment in new plant and equipment is brought forth so that all of us can understand it by McGraw-Hill's annual survey of American industry's plans for investment in new plant and equipment in 1950, which has just been completed.

continued on next page

BUSINESS' PLANS FOR 1950

These are the major findings of the McGraw-Hill survey of "Business' Plans for New Plants and Equipment" in 1950. Made by the McGraw-Hill Department of Economics, the survey shows:

1. Industry – as represented by manufacturing, mining, transportation, and utilities – now plans to invest $12.4 billion in new plants and equipment this year. This is 13% less than was actually spent last year.

2. Manufacturing industries alone plan to spend $6.3 billion in 1950 for new facilities. This is also 13% less than they spent last year.

3. Manufacturers as a whole expect their 1950 sales volume to about equal 1949's.

4. Manufacturers will expand their capacity about 3% in 1950, under present plans. The largest part of their funds, 65%, will go to replace and modernize existing facilities.

5. Profits and reserves are expected to provide 92% of the 1950 investment funds of manufacturing companies. These companies count on new common stock issues to provide less than one-half of one per cent of the investment funds they will need.

6. Two out of three manufacturing companies review their investment plans monthly. Almost all companies go over them at least quarterly. The survey shows that companies changed plans rapidly during 1949 to meet changes in their prospects.

7. Other industries are also reducing their investment plans in 1950 by 13%. This coincidence arises from the fact that utility companies, notably the electric light and power companies, plan to spend only slightly less than in 1949. Railroads, on the other hand, are reducing their capital programs in 1950 by more than 40%.

A copy of a complete report on "Business' Plans for New Plants and Equipment" may be obtained by writing me at McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

The results of the survey, which are summarized above, show that American Industry – as represented by manufacturing, mining, transportation and utilities – is planning to spend 13 per cent less for new plant and equipment in 1950 than it did in 1949.

Since the rate of investment in new plant and equipment right now is apparently about 15 per cent below the rate for 1949, the present level of business investment may be relatively steady in 1950. That would relieve the fear, expressed by President Truman in his Economic Report, that "if the downward trend in business investment were to continue, our prospects for full recovery and continued expansion would be seriously endangered."

BUT, at the rate of investment planned by American manufacturing industry for 1950, it would take 40 years to modernize thoroughly our present industrial plant and equipment. That would still leave undone the job of increasing it to meet the needs of an expanding economy of the kind sketched by President Truman in his message.

In attaining even this rate of investment, the McGraw-Hill survey shows American business must rely overwhelmingly on its own profits, which have declined as the country has left the postwar boom behind it. Most American companies cannot sell new common stock except at ruinously low prices. Here is one case where government action is really needed to help business and help to keep a rising American standard of living.

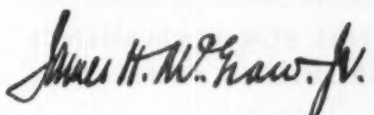
In order to get enough business investment to assure the "full recovery and continued expansion" sought by the President, our country needs:

1. Lower taxes on business income so as to release more money for new plant and equipment.

2. Liberalized depreciation allowances on old plant and tools so that business can buy new equipment faster.

3. Repeal of the present double taxation of dividends which now are taxed once as corporation income and again as personal income.

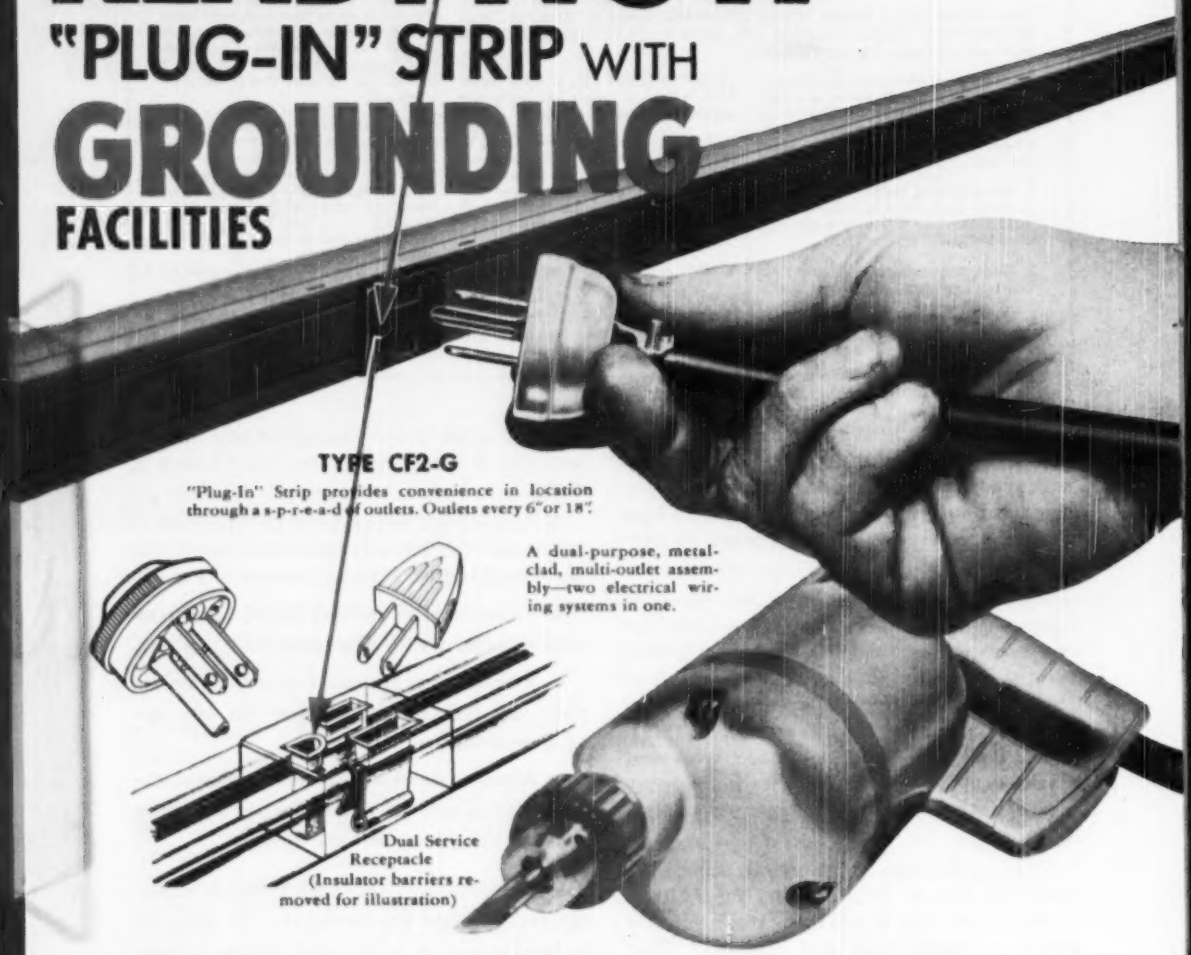
It is encouraging to have the President explicitly recognize the key importance of adequate business investment in providing steadily expanding prosperity. The next and most important thing to do is to make this recognition effective by discarding national policies which are blighting an adequate volume of business investment.



President, McGraw-Hill Publishing Company, Inc.

READY NOW

"PLUG-IN" STRIP WITH GROUNDING FACILITIES



TYPE CF2-G

"Plug-In" Strip provides convenience in location through a s-p-r-e-a-d of outlets. Outlets every 6" or 18".

A dual-purpose, metal-clad, multi-outlet assembly—two electrical wiring systems in one.

Dual Service Receptacle (Insulator barriers removed for illustration)

Type CF2-G Grounding "Plug-In" Strip permits use of grounded or ungrounded devices *from the same outlet* . . . Will take either the new *Series* 5200 3-blade grounding plug or the standard 2-blade ungrounded plug.

STEEL FOR PERMANENCE
GROUNDED FOR SAFETY

Listed by Underwriters' Laboratories, Inc.

UNLIMITED APPLICATIONS . . . in FACTORIES . . . OFFICES . . . STORES . . . HOMES . . . HOTELS . . . APARTMENTS . . . SCHOOLS . . . HOSPITALS . . . INSTITUTIONS . . . "Plug-In" Strip is a professional material. Consult your electrical contractor for installation. *Grounding* "Plug-In" Strip meets contemplated revisions in the National Electrical Code covering grounded electrical systems. Type CF2-G Grounding "Plug-In" Strip is the quickest and easiest method of meeting grounding requirements. Write for our *free* folder "Grounding Plug-In Strip."

Everything in wiring points to NE

National Electric
PRODUCTS CORPORATION

1305 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PENNSYLVANIA

Industrial Opportunities

In 1950 MANUFACTURERS will spend at the boom-time rate of $6.3 billion for capital expansion and modernization. Out of this total 35% or $2.2 billion will go for expansion and 65% or $4.1 billion for replacement and modernization. These estimates compiled from a survey by the McGraw-Hill Economics Department show convincingly how important the industrial market is for the electrical industry.

Today, industrial plants consume more than half of the total output of power companies and provide about 30% of the total revenue. Each American factory worker is backed up by about 8 hp. The utilities and their power salesmen deserve a great deal of the credit for this fine record of the acceptance of electric power by American industry. Another large element of credit must go to the industrial electrical engineers and consulting engineers. Working in unison these groups can increase still further the use of power for production, the earnings of workers, and the productivity and profits of American industry and can bring desirable revenue to the utilities' coffers.

ELECTRICAL WORLD takes cognizance of the great progress made to date and the magnificent opportunities in the industrial field that lie ahead. We see the need for active promotion of industrial equipment on the part of utilities, modernization of distribution facilities in industrial plants, and constant efforts on the part of industrial, electrical, and consulting engineers to add to and improve plant equipment.

In speaking before the Southeastern Electric Exchange, Robert G. Ely of Public Service Electric & Gas Co, Newark, and chairman of the Industrial Power and Heating Section of Edison Electric Institute said:

"If we do a good methods or industrial engineering job in helping our smaller and medium sized customers lower their production costs, it will be very time consuming; and the volume of new business may appear quite small. On the other hand, if we push ahead with some new plan for marketing 'off-the-shelf' applications without regard to the real problems many of our customers are facing today, we may lose as much load through business failures as we gain through the sale of new equipment. Is it possible to do both? I think it is, and I think this is the challenge in industrial power sales today."

Recent growth in industrial power loads has caused a severe strain upon plant distribution facilities. Transformers, breakers, and internal circuits are subject to breakdown if modernization activities are not pushed. Capacitors and load center distribution have not been applied in many opportune cases.

Further applications of electric heat, electronic controls, air treatment, lighting, materials handling, and motors are unlimited.

Set the goal for 9 hp per worker by 1955. Reach it by greater promotional efforts than ever before attempted in the field of industrial selling. Provide adequate distribution and control equipment. This is the program which ELECTRICAL WORLD urges the electrical industry to adopt. The successful completion of this plan will be of great benefit to all.

Towards Better Understanding of Business by Educators

ANY POWER COMPANY president who wants to experience an abrupt rise in blood pressure can probably realize his desire by reading about electricity supply in the economics text book studied by his offspring in high school or college. In general, these texts take a dim view of private enterprise in the power business, leaning quite definitely towards government ownership. To a greater or less degree this dim view of the profit motive by the academic eye encompasses all kinds of business.

This is a condition that can be cured. The writers of text books and the teachers certainly are on the average no less intelligent and fairminded than men in the business world. The reason views of writers and teachers are often dim and distorted is that a clear insight has not been opened to them. And that is largely the fault of those who want their animations and acts to be seen clearly and whole—business men themselves.

The cure lies in disclosing the operations of business to the academic mind. Organized to this purpose is the College-Business Exchange Program, administered by the Foundation for Economic Education, Irvington-on-Hudson, New York. In the program, fellowships are granted by business firms to staff members of colleges and universities, giving to such members training in the business firms' operations, in a 6-week summer period. By this means the fellows get a true picture of business affairs.

Starting in 1948 on a very small scale, the program has now demonstrated that it can have a far-reaching influence on understanding between business men and academic personnel. In the first two years 41 fellowships were granted by 22 business firms to persons from 27 colleges and universities. That is a good start on a program that should grow much larger. All business men who want to help it grow should write for information to W. M. Curtiss of the Foundation at the address given above.

Hotpoint Urges Merchandising

"THE APPLIANCE business in general, the dealers' business in particular, and the need for increased revenue by the electric utilities, suggest a revival of full-scale direct selling by utility companies."

"In addition to increasing revenue, a major appliance selling program is capable of producing a merchandising profit that will, to a large extent, off-set the cost of other promotional activities."

In such terms as these, Hotpoint, Inc. makes a case for utility merchandising of major appliances in an analysis of the problems of tomorrow's load building now being presented to individual electric utilities. By selling the appliances themselves, the power companies pioneered the refrigerator, the range, the water heater, because dealers were not in position to undertake the required expense of promotion and introductory selling. Of the three appliances, the refrigerator is the only one that has gained such public acceptance as to remove it from the halls of specialty merchandise. The range and the water heater still need the push of utility selling. Additionally, there have come upon the scene other appliances that may be classed as "major"—the food freezer, combination refrigerator and freezer, dishwasher, garbage disposer, automatic washer, clothes dryer, blanket—all of which will require for firm establishment in public acceptance more time, money, and effort than the dealer can afford to give them.

To merchandise or not to merchandise has always been a controversial question among electric utilities. Some believe in merchandising firmly. Others as firmly reject the thought. Some who reject it assert that a better job of inducing public acceptance of major appliances can be done by cooperation between utility promotion and dealer selling. And others, we must sadly report, neither sell themselves nor help dealers to sell.

It is not for ELECTRICAL WORLD to urge non-merchandising utilities to enter direct selling of appliances. We believe that is for the utility to decide for itself. But we must comment on the high significance of one of the largest producers of appliances in the country so forthrightly espousing the cause of utility merchandising. That is something to think about. Perhaps it will suggest re-examination of their positions by some non-merchandising utilities.

Management Meets Labor

A CONFERENCE for the discussion of mutual problems was staged by the IBEW locals and the Arizona utilities in December. According to all reports from the meeting, it was an outstanding success and much good will was evident. In voting to decide whether future conferences should be held there was only one opposition vote.

On labor's side, the meeting gave the union leaders a chance to reiterate their stand in opposition to the continuing drift toward Socialism. Some might immediately question labor's good intentions in this regard, but none can find a better place for management to present the facts on this important question. Some of the significant elements in the survival of free enterprise were presented in the way of the outlook for utility expansion and employee relations. Other subjects even more to the point could have been covered, but these can wait for conferences to come.

The important lesson to be learned from this experience is that members of unions welcome an opportunity to meet with utility management to discuss common problems. By having a state wide meeting, the relations can be less personal than within a single company. When a joint committee sets up the program, no one can fairly criticize their choice. Here is another great opportunity for leadership by each utility in every state of the union.

The Electrical Week

Pacific Power & Light Co has been sold to a syndicate headed by Bear, Stearns & Co and A. C. Allyn & Co. Sales price was $16,125,000 for the 500,000 shares of PP&L common held by American Power & Light Co. But best of all the syndicate promises that it will retain the present management (p 64) . . . You can forget about the proposed Columbia Valley Administration, at least for a time. The President gave it a paralyzing blow with his recent approval of the Army Engineers-Interior Department agreement for joint development of water resources of the Columbia River Basin (p 66) . . . The Reclamation Bureau is negotiating with eight power companies for sale of power to be produced at six hydro plants in the Missouri Basin (p 67) . . . For the third time this year a new electric energy production record has been set. This time the record is 6,062,095,000 kwhr for the week ended Feb 4 (p 71) . . . And EW is adding another monthly feature. Its a chart showing the peak loads of Class I utilities. Estimates by Edison Electric Institute make it the latest information available on this subject (p 71).

• • •

A Springfield, Mass., manufacturer is going into the heat pump field. Pilot installations operated by 1/3-hp motors are now being commercially tested.

For three weeks Douglas B. Maggs, law professor at Duke University and former Solicitor of the Department of Labor, has been hearing IBEW ouster charges against Harry Van Arsdale, Jr, business agent of powerful Local 3 in New York. Maggs will make findings of fact on which the Executive Council will act.

A new report by a political scientist finds "a significant lack of sentiment for municipal incorporation" in Bureau-of-Reclamation-operated Boulder City, Nev., Interior announces proudly.

REA Administrator Wickard says he hasn't even considered approving the giant loan sought by First Iowa Hydro-Electric Cooperative to develop power on the Cedar River. Reason: Co-op has failed to show it has a market for the power it hopes to produce.

Mississippi Representative William M. Whittington, who as Chairman of the House Public Works Committee plays an important role in Congressional deliberations on power construction, has announced he will not be a candidate for reelection this fall. In line to succeed him in the Public Works post is Democrat Charles A. Buckley of New York City, if the Democrats retain control of the House.

There doesn't seem to be any limit to Grand Coulee's ability to set new records. In January, when the Northwest was hit by the severest cold wave since grandpaw was a boy, Grand Coulee turned out 1,022,000,000 kwhr of electric energy. This is said to be a world's record for hydro production accomplished by a single plant in the period of a month.

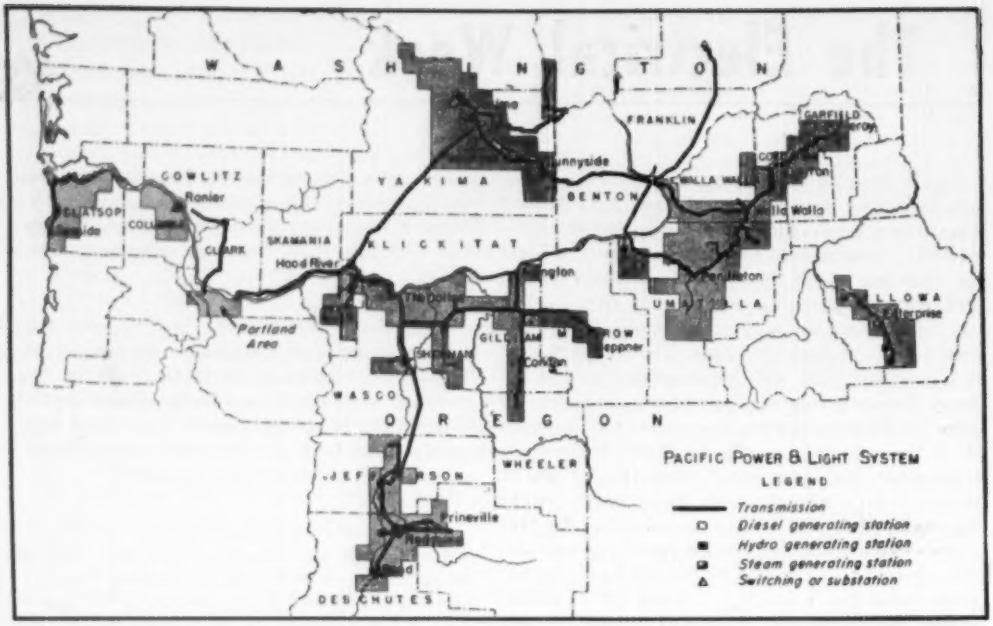
Field of candidates for the vacant post of Under Secretary of Interior has narrowed to two men, Washington sources report. John W. Gibson, Assistant Secretary of Labor since 1945 and former president of Michigan CIO Council, has strong support. But Assistant Interior Secretary Davidson still ranks as the likely choice.

The Rural Electrification Administration will make its first phone loan approval this month.

Oklahoma Gas & Electric Co has asked FPC okay for sale of its 138-kv, Brown-to-Russett, Okla., line to Southwestern Power Administration for $530,000. Transfer would link two SPA lines and iron out possible snag in proposed OG&E-SPA contract.

Notes From The News

A thaw following a recent ice storm cost the Clark County PUD, Vancouver, Wash., over $200,000 in damage and for repairs . . . When a short circuit occurred in a distribution circuit of the Pennsylvania Power & Light Co at Allentown, one of the buildings without power was the company's 22-story headquarters, the highest building in the Lehigh valley . . . Virginia Electric & Power Co has been notified by the International Brotherhood of Electrical Workers, representing about 4,000 employees, that it wants to open negotiations for a new contract . . . The Lamoille (Vt.) County jail is without electric service because of nonpayment of bills. The Morrisville Light & Power Co cut off service when the state auditor refused to pay the last two bills, claiming they were too high. The sheriff blames the increase on the installation of a water heater.



Pacific P&L to Stay Private Power

Syndicate Headed by Bear, Stearns & Co and A. C. Allyn & Co Gets Approval of SEC for Its Bid of $16,125,000 for Controlling Interest of Company

PACIFIC POWER & LIGHT CO will continue operations—for the time being, at least—under its present management, new owners of the Northwest utility announced this week. Possibility of sales of portions of the Pacific system to public ownership groups in the near future is remote, the same sources asserted.

A syndicate headed by Bear, Stearns & Co and A. C. Allyn & Co, both New York investment firms, cleared the final hurdle to acquiring all the common stock of Pacific on Feb 3. On that date the Securities and Exchange Commission approved the group's bid of $16,125,000 for the 500,000 shares of Pacific common held by American Power & Light Co.

Thus ended a month-long scramble for control of the utility. It was touched off early last month by American's announcement that it proposed to sell its holdings in Pacific to a buying group headed by B. J. Van Ingen & Co. The Van Ingen group was planning resale of portions of Pacific's physical properties and had contracted with Guy C. Myers to negotiate with public utility districts interested in Pacific's assets.

This announcement was followed by an offer to buy Pacific from a syndicate headed by Allen & Co, also of New York. The latter group stated it would maintain private ownership and management of the property if its bid were accepted.

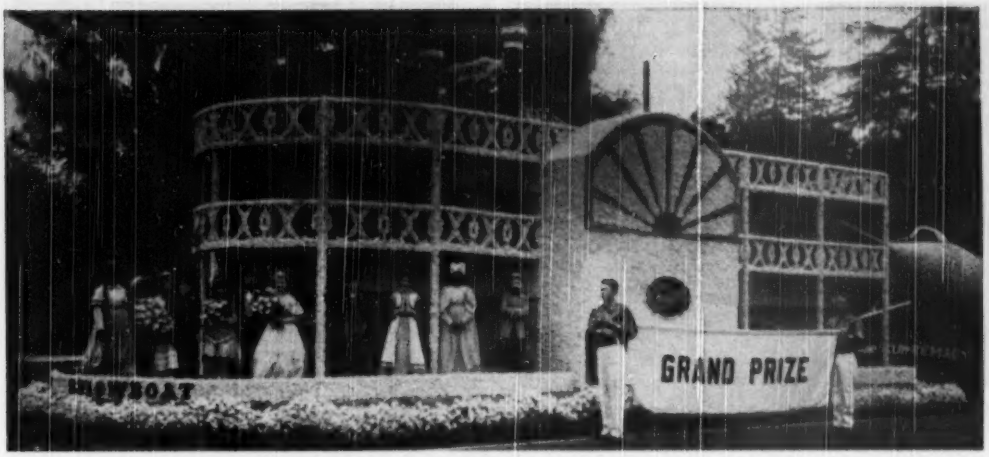
American expressed a preference for the Van Ingen offer of $10 million in cash plus a portion of the return from resale of Pacific's stock or physical assets. But the Allen & Co bid of $15 million cash was submitted as a possible alternate in an application for exemption from SEC's rule requiring competitive bidding in sales of holding company securities.

SEC granted American an exemption from competitive bidding in disposing of Pacific, but it refused to extend the exemption to the Van Ingen and Allen & Co bids. Neither, the commission ruled, was negotiated under "competitive conditions." It instructed American to negotiate new bids under "competitive conditions" (EW, Feb 6, p 13).

Last week the holding company went before the commission with two new bids, the Allyn-Bear, Stearns offer and a second from the Allen & Co group. The latter amounted to $15,525,000 plus two-thirds of net profits above 10% of the purchase price. American stated its preference for the Allyn-Bear, Stearns cash offer. It rejected a subsequent proposal by the Allen & Co group to guarantee American $16,325,000, which was made orally during the hearing before SEC.

The successful Allyn-Bear, Stearns group consisted of most of the financial houses participating in the old Van Ingen offer, plus a few newcomers. However, the Van Ingen firm and John Nuveen & Co, which in the past have dealt extensively in municipal and other public ownership securities, occupied positions of lesser prominence.

As managers of the new group, A. C. Allyn and Bear, Stearns reserved for themselves and their own clients major portions of the Pacific stock. The purchase agreement contemplated ownership of 344,961 shares by these firms, as follows: A. C. Allyn & Co, 57,752 shares; Bear, Stearns & Co, 57,742; Marianna Securities Corp and C. S. Mott, 46,511.5 each; Stifel, Nicolaus & Co, 15,504; and Alleghany Corp, 120,930. The Nuveen and Van Ingen firms



"SHOWBOAT," entry of Southern California Edison Co in annual Tournament of Roses parade held at Pasadena, Calif., won the Grand Prize as most beautiful commercial entry. "Showboat," one of the largest floats ever entered in the annual parade, was larger than average six-room house, weighed 12½ tons, and was covered with more than 1.2 million blossoms. Thirty-four loud speakers broadcast music of the showboat era, and machines provided smoke for stacks and synthetic steam for exhausts. Costumed passengers are school children

were listed as prospective holders of 31,008 and 15,504 shares, respectively.

These major participants contributed the following amounts of the total purchase price: Allyn and Bear, Stearns, $1,852,500 each; Nuveen, $1 million; Van Ingen, $500,000; Marianna Securities and C. S. Mott, $1.5 million each; Stifel, Nicolaus, $500,000; Alleghany Corp, $3.9 million. Other members of the group, the shares they were scheduled to receive and their contributions follow:

Robinson Humphrey	15,504	$500,000
Foster & Marshall	15,504	500,000
Hartley Rogers & Co	15,504	500,000
Donner Corp.	31,008	1,000,000
Cruttenden & Co	4,651	150,006
First Cleveland Corp	7,752	250,000
Dempsey & Co	15,504	500,000
Peltason, Tenenbaum	15,504	500,000

The successful syndicate also obtained a limited exemption from compliance with provisions of the Holding Company Act. This exemption, which may be revoked by SEC, permits the group to dispose of its utility holdings without express approval of the commission. But it must notify SEC ten days in advance of any transactions involving the Pacific property.

In a statement Feb 7, date the sale of Pacific became effective, the new owners revealed they had conferred with Paul B. McKee, president, and other officers of the company.

"First of all," the statement added, "the company will continue under the present management to render the best possible service to its customers at the lowest possible cost. This is and will continue to be the primary purpose of the company.

"All other considerations are secondary. We have purchased the common stock of this company because we believe in its future—we are thoroughly convinced of the future of the Pacific Northwest after many years of study of this region.

"We have, at the present moment, no plans for the disposition of this stock. As American bankers, we believe in the future of American private enterprise. It is our hope that ownership of this common stock will eventually be held to a large extent by the residents of the Pacific Northwest."

•

Granted FPC License

Wisconsin Public Service Corp, Milwaukee, has been granted a license for its existing Otter Rapids hydroelectric development on the Wisconsin River near Eagle River in Vilas County. The license will run from Jan 1, 1938, to June 30, 1970. The project has a capacity of 750 kw.

•

Virginia CC Changes

Judge Marshall King has been elected chairman of the Virginia Corporation Commission to succeed Judge H. Lester Hooker. The chairmanship is rotated annually. Judge Ralph C. Catterall has been appointed to the commission to succeed Judge L. McCarthy Downs, who resigned to enter private industry.

Truman Asks $7 Million for TVA Steam Plant

President Truman has asked Congress to appropriate $7 million to start construction immediately on the Tennessee Valley Authority's $37 million, 250,000-kw Widows Creek steam plant in northeastern Alabama (EW, Dec 24, p 13).

The request was contained in a supplemental appropriation estimate for the current fiscal year ending June 30. TVA also asked for additional amounts of $5 million for construction now under way and $365,000 to cover pay increases voted by the last session of Congress.

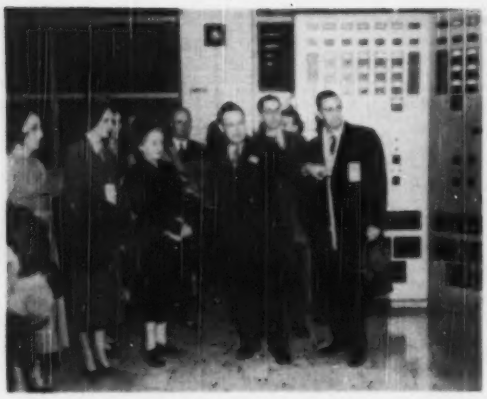
TVA's newest steam plant is needed, it was explained, to supply new power requirements of the Atomic Energy Commission's Oak Ridge installation. For the fiscal year starting July 1, $15.4 million was asked in the budget for the Widows Creek project.

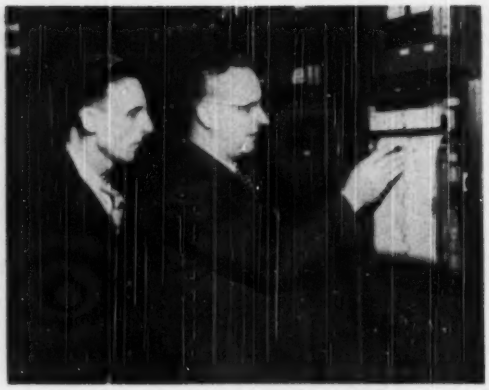
In another supplemental appropriation request, the President sought a $50 million loan fund for the Rural Electrification Administration's telephone program. Salaries and expenses for administration of the phone program were set at $2.1 million.

•

BPA Gets Storage Space

The Bonneville Power Administration has secured permission from the U. S. Maritime Commission to use 125,000 sq ft of Vancouver shipyard space. The action will permit consolidation of BPA's temporary storage areas.





IT'S THREE O'CLOCK in the morning, but this group of Philadelphia school teachers, principals, and officials is getting an explanation of the control room operation at the Southwark Station of Philadelphia Electric Co. In the right panel, a school principal learns the problems of frequency control from George Richard, assistant superintendent of Southwark. The group spent a night studying various industries

Truman Approval of Army-Interior Pact Seen as Slowing CVA Drive

THE TRUMAN ADMINISTRATION's push for a Columbia Valley Administration patterned after TVA apparently has lost most of its steam—at least for the time being.

Latest of a series of developments indicating a slowing of the CVA drive was provided by the President, himself. On Feb 2, the White House finally okayed an Army Engineers-Interior Department agreement for joint development of water resources of the Columbia River Basin.

Submitted to the President last April, the Army-Interior accord had been stalled ever since by White House inaction. Meanwhile, the Administration fought unsuccessfully for Congressional approval of legislation establishing a CVA. And proponents of the latter proposal attacked the Army-Interior plan on the grounds that a CVA could do a better job of developing the Pacific Northwest.

Last month the President mentioned CVA only briefly in his annual budget message, in contrast to his ringing appeal for the project a year before. And other Administration spokesmen prominent in last year's fight for CVA recently have been talking more of power in the New England area than in the Northwest.

The President's endorsement of the Army-Interior program, which was forwarded to Congress by those Departments, contained only secondary encouragement for CVA boosters. The program, he said, would bring about the establishment of a better organizational framework for such an agency.

Meanwhile, a close "coordination of their respective programs which has been effected by the Departments of the Interior and Army is essential."

The approval clears the way, providing Congressional authorizations and appropriations follow, for a start on some $1,874 million of new development projects, including appurtenant power installations with a total capacity of 5,241,600 kw.

As it was finally approved by the President, the program would split the work dollarwise into a total of $1.5 billion for the Engineers and $374 million for Interior's Bureau of Reclamation.

Also approved was the establishment of a "basin account to permit a more intelligent accounting for power revenues from the various federal hydroelectric plants in the Pacific Northwest and for the various costs which are to be returned from those revenues." This procedure would permit the pooling of costs and revenues of projects undertaken by both agencies in respect to power facilities. It also would provide for greater assistance from power revenues to pay for irrigation costs throughout the region.

The President snipped one irrigation development from the program submitted by Army and Interior. This was a $222 million irrigation plan connected with Reclamation's Mountain Home Project. But two power features of the Mountain Home development, the Scriver Creek plants, were okayed. Some navigation and harbor work, that had been planned by the Army, was also deleted.

Major multiple-purpose projects of the Engineers and their power installations, for which authorization was requested, include: Libby, 588,000 kw; Albeni Falls, 42,600 kw; Priest Rapids, 1,219,000 kw; John Day, 1,105,000 kw; The Dalles, 980,000 kw; Willamette River dams, 287,000 kw in eight plants. Reclamation projects that have been approved and their estimated power capacity are Hell's Canyon, 900,000 kw, and the Scriver Creek developments, 120,000 kw.

•

1st 36,000-Kw Unit Now Operating at Allatoona

Allatoona Dam, the Army Engineers' flood control project on the Etowah River in Georgia, began producing hydroelectric power Feb 1, Maj. Gen. Lewis A. Pick, Chief of Engineers, announced. One 36,000-kw unit went into production. A companion 36,000-kw turbine generator is scheduled to go on the line in April.

Allatoona Dam, a concrete structure 190 ft high and 1,250 ft long, is the first project in the comprehensive plan for control and development of the Alabama-Coosa River system. It is the sixth multi-purpose project of the Corps of Engineers to produce hydroelectric power.

As now equipped, the other projects are: Bonneville, 518,400 kw; Denison, 70,000; Fort Peck, 50,000; Dale Hollow, 36,000; and Norfork, 35,000. Addition of Allatoona brings power installations at the six projects to an overall total of 745,400 kw.

CEMENT BATCHING plant and tunneling equipment rests behind Garrison Dam, near Williston, N. D. Project, being built by Army Engineers, will have 80,000-kw capacity

Reclamation Arranging Missouri Basin Power Sale to 8 Companies

INTERIOR DEPARTMENT'S Bureau of Reclamation is negotiating agreements with eight power companies for sale of power to be produced at federal hydro plants in the Missouri Basin within the next four years.

Six plants now being built by Reclamation and the Army Engineers will have an installed capacity of at least 424,100 kw by 1954. Although most of the firm power involved is certain to go to federal preference customers, Reclamation, which will market the power, is negotiating four types of contracts with companies. According to Reclamation sources, these include:

1. "Wheeling" agreements, under which power companies will carry federal power to federal customers;

2. Interchange arrangements between company systems and federal plants and lines;

3. Standby contracts, covering emergency power needs of both company and government systems;

4. Sales of power to private utilities. Sales will consist primarily of secondary power, but Reclamation engineers estimate there will be considerable amounts of such power.

Interior has signed no contracts with companies, but negotiations are considered to be progressing satisfactorily. Meanwhile, the Department is encountering snags in dealing with preference customers. Chief trouble areas are Nebraska and South Dakota.

Bitter disputes between the public bodies that comprise the Nebraska Public Power System have made it impossible for Reclamation to negotiate any contracts there. Rate and distribution problems in the state, Interior Secretary Chapman charged in a recent speech, "have delayed the marketing of public power in Nebraska."

"You cannot afford, nor can we afford, much more delay," he warned the state. "We are actively negotiating and planning for definite contractual arrangements in every basin state except Nebraska."

The Nebraska situation also has contributed to the power marketing problem in South Dakota. Nebraska's share of power from such dams as Fort Randall in South Dakota will be sizable. And South Dakota has more private than preference customer-public power systems.

One solution for this dilemma, proposed by South Dakota Gov George T. Mickelson, has been rejected by Chapman. The governor proposed setting up a state power agency which as a state body would qualify as a preference customer. It then might buy federal power for resale to existing power systems in South Dakota.

Chapman said Reclamation's contracts would provide for withdrawal of any power which a preference customer sold to private utilities. Power companies, Chapman wrote Mickelson, "would thus have the same nonpreference status in their rights to purchase power from the federal projects if they were served by the state agency that they would if they were served directly by the government."

The South Dakota Legislature is now in special session to consider two of the governor's bills. One provides for a state power authority, the other for public power districts.

In its present negotiations with power companies, Reclamation cites as a precedent its "wheeling" arrangement with Montana-Dakota Utilities Co for power from Fort Peck. This agreement is "working very well," a Reclamation spokesman says.

Companies now negotiating include Otter Tail Power Co, Black Hills Power & Light Co, Northern States Power Co, Iowa Public Service Co, Montana Power Co, Public Service Co of Colorado, Mountain States Power Co, and Northwestern Public Service Co.

Hydro power for which marketing arrangements are now being discussed will come largely from the big Dakota dams. These are Fort Randall, scheduled for completion in 1953 in South Dakota, and North Dakota's Garrison Dam, which will begin operations the following year. Both are listed for installations of 160,000 kw, though Garrison will have an ultimate capacity of 240,000 kw.

A total of 104,000 kw also will be available from four dams in Colorado and Wyoming within two years. These plants, their power installations, and completion dates are Estes, Colo, 45,000 kw (1950); Kortes, Wyo, 36,000 kw (1950); Boysen, Wyo, 15,000 kw (1952); and Marys Lake, Colo, 8,100 kw (1950).

•

4 Diesels Added in Ontario

Four additional Diesel units have been installed at the Hamilton, Ont., plant of the Hydro-Electric Power Commission of Ontario. The units will add 1,350 kw to the capacity of the plant, complementing the output of two 5,000-kw steam units placed in service last November.

•

Wins Oregon Contract

A five-year contract to provide electricity and steam heat to the new state office building in Portland, Ore., has been awarded to the Pacific Power & Light Co. The losing competitor was the Portland General Electric Co, which supplies electricity for most of the state buildings in the Salem area.

MEDALIST'S SON, Harrison L. Jewett, right, accepted the Hoover Medal which was awarded to the late Dr Frank B. Jewett, president of Bell Telephone Laboratories. At left is Dr Karl B. McEachron of General Electric Co, recipient of the Edison Medal. Presentations were made at Winter Meeting of the American Institute of Electrical Engineers

Electrical Engineers Given Awards at AIEE Winter General Meeting

ELECTRICAL ENGINEERS, in various fields were honored at the recent Winter General Meeting of the American Institute of Electrical Engineers at New York.

Dr Karl B. McEachron, manager of Engineering, Transformer and Allied Products Divisions of General Electric Co and internationally recognized authority on lightning, was given the Edison Medal (EW, Jan 9, p 11).

The Hoover Medal, awarded to Dr Frank B. Jewett, was accepted by his son, Harrison L. Jewett, an electrical engineer on the staff of the Brookhaven National Laboratory. The medalist, a former president of Bell Telephone Laboratories and of AIEE, died Nov 18 (EW, Dec 3, p 150).

Five prizes of $100 and a certificate each were awarded to the authors of the outstanding technical papers prepared for meetings of the Institute between Jan 1, 1948 and July 31, 1949. Six runners-up were awarded certificates.

Awards were made for these papers of interest to electric utilities and manufacturers:

"Are the Overhead Distribution Costs Retarding Railroad Electrification?" L. W. Birch, Ohio Brass Co; "Voltage Recovery Characteristics of Distribution Systems," R. L. Witzke, Westinghouse Electric Corp; "A Study of A-C Arc Behavior Near Current Zero by Means of Mathematical Models," T. E. Browne, Jr. Westinghouse Electric Corp; and "Hy-Therm Copper—An Improved Overhead-Line Conductor," L. F. Hickernell, A. A. Jones, and C. J. Snyder, Anaconda Wire & Cable Co.

Vannevar Bush, president of Carnegie Institution of Washington, who earlier had been made an honorary member of AIEE, was inducted into Eta Kappa Nu, electrical engineering honor society. Two others inducted with him were Royal W. Sorensen, professor of electrical engineering, California Institute of Technology, and Vladimir K. Zworykin, vice-president, Radio Corp of America. The Eta Kappa Nu inductions were held in conjunction with the AIEE meeting.

•

Nova Scotians Seeking Area, Not Line Density

"Area coverage, not mile density" is the new motto of the Pictou County, N. S., County Council. It is campaigning for a change in the rural electrification regulations of the Nova Scotia Power Commission.

The trouble is caused by the present regulations requiring four customers per mile of line. Eight miles of a proposed 14-mile line have been built. There are 50 customers on the first eight miles. There are four customers for each of the next three miles. But the line cannot be extended the final three miles because there are only two customers to the mile. The council wants the entire line to be considered as one project.

PUC Backs Pacific G&E in 'Wheeling' Controversy

The federal government's case to force Pacific Gas & Electric Co into "wheeling" power to government agencies in California was dismissed Jan 17 by the Public Utilities Commission.

The Commission did not rule on the "wheeling" issue, deciding that the government's presentation did not call upon it "to decide whether or not it has the authority to compel the company to perform 'wheeling' or exchange service for the government."

Heard late in 1948, the suit asked that the Commission establish a special class of service providing for an exchange or wheeling of power between the government and the company and fix rates for such service. The service was asked for 25 government agencies having a demand of 500 or more kw.

The government claimed that in fact it was already exchanging power with the company, delivering power at Shasta and a number of government bases, and in turn accepting delivery of power from the company at its agencies. It asked that the service be "recognized" as a different class from the ordinary commercial service.

Granting PG&E's plea for dismissal, the PUC ruled that if the government were not seeking a new class of service, but only the establishment of a new rate schedule, it should have made known "with reasonable certainty, the particular type of rate relief it is demanding."

It further declared that it had not been shown that rates now charged by PG&E are "in any respect, prejudicial, unreasonable or otherwise unlawful."

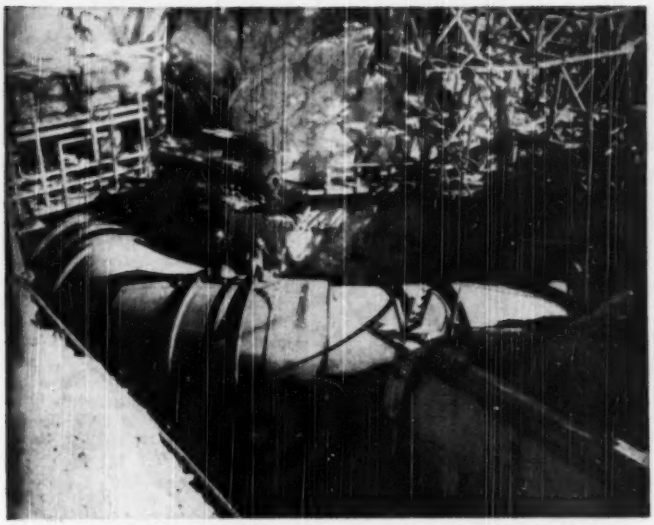
PG&E had protested (EW, Nov 6, p 78) that the "wheeling" service was not one it had undertaken to give as a public utility service, and that forcing it to give such service would amount to seizure of its property.

It charged the Bureau of Reclamation with attempting to move into the utility business in California in competition with PG&E, using company transmission facilities to help take away company customers. It cited "discussions" the Bureau had had with a number of northern California municipalities for sale of Shasta power.

•

Municipal to Be Sold

Spencerville, Ohio, Town Council has voted to sell the municipal power plant and distribution system. The action followed a threat by the town's leading industry to move elsewhere unless better electric service were provided. The system is 50 years old.



FINAL SECTION of 15-ft-dia steel penstock at Anderson Ranch Dam near Boise, Idaho, is installed. Plant will house three generators with a total capacity of 40,500 kw

FPC Denies Rehearing but Amends Idaho Terms

Idaho Power Co's controversial transmission lines from its Bliss hydroelectric plant will not be the subject of a rehearing by the Federal Power Commission, but the Commission has modified the terms under which it ordered the company to carry Federal power (EW, Oct 22, p 89).

FPC last month:

1. Denied Idaho Power's Nov 10 petition for a rehearing on the Commission order of Oct 13.

2. Amended the order to provide that Federal Power agencies using spare capacity on the company lines must reciprocate by making available to Idaho Power any unused capacity on government lines.

3. Reduced from 30 to 24 months the period of notice required of the company to repossess lines in use by the government.

4. Clarified provisions of the license order relating to fishery resources.

5. Turned down a request of the Secretary of the Interior for further protection for Reclamation projects.

6. Dismissed formal complaint by the Secretary against the order.

Reciprocity in using lines of the government was provided the company under the same terms as the federal use of company lines. Federal use of Idaho Power lines was made contingent upon reciprocal rights to the company.

Finding that the 30 months' notice was longer than necessary, FPC said that any decision about repossession of lines could be made in 15 months. An additional nine months would provide time for the government to build substitute capacity for the lines which Idaho Power completed in less than eight.

Fish protection provisions of the original order were not clear, FPC noted, amending its order to provide for construction by the company of fish life facilities as ordered by the Commission.

Standard license provisions for protection of Reclamation facilities were held to be adequate without the modification requested by Interior.

Four members of the Commission ruled on the latest round of the Idaho line fight, with Commissioner Mon C. Wallgren not participating.

•

Jersey Central Workers Get 4% Wage Increase

Manual workers of Jersey Central Power & Light Co have been awarded a wage increase of 4% with split breakage—if the increase is over half a cent, the worker gets the full cent. The award by a State Mediation Board Arbitration Panel has been accepted by both company and the union. The contract is retroactive to Sept 1, 1949. The union had asked for a 10% raise.

The company has asked the union to reopen contract negotiations for clerical workers, who have already accepted the company's offer of 2%. The company wants them to have a raise equal to that won by the manual workers.

October Energy Sales Down 1.1% from 1948

Electric energy sales declined in October as compared to the corresponding period of 1948. This was the first decline in several months.

Sales to ultimate customers totaled 20,292,563,000 kwhr, a 1.1% decrease from the 20,510,530,000 kwhr sold in October, 1948. Revenues from ultimate customers amounted to $383,250,200, a 4.2% increase over the $367,712,000 received in October, 1948.

Classification of Sales, October

Kilowatthour Sales September	Million kwhr 1949	Million kwhr 1948	Percent Change
Residential or domestic	4,749	4,172	+13.9
Rural (Distinct rural rates)	626	570	+ 9.8
Commercial or industrial			
Small light & power	3,876	3,634	+ 6.7
Large light & power	9,693	10,796	— 9.4
Street and highway lighting	251	233	+ 7.7
Other public authorities	581	526	+10.4
Railways and railroads			
Street and interurban	289	320	— 9.9
Electrified steam railroads	182	210	—13.5
Interdepartmental	46	50	— 7.3
Total to ult. cust.	20,293	20,511	— 1.1

For the 12 months ended Oct 31 the average use per residential customer was 1,664 kwhr, or 8.1% above the previous year, when the figure was 1,540 kwhr. The average annual bill rose 5.9%, from $46.51 to $49.25, and revenue per kwhr fell 2%, from 3.02¢ to 2.96¢.

•

FPC Wants to Extend Competitive Bidding Rule

Federal Power Commission plans to require competitive bidding on negotiated security sales by firms under its jurisdiction.

A proposed amendment to the commission's rules would add this group of sales to the underwritten ones, for which competitive bidding already is compulsory. The change would bring commission policy in this area into line with that of Securities and Exchange Commission.

SEC would continue to have prior jurisdiction over holding companies and their subsidiaries. But, if the new rule is adopted, interstate utilities not subject to SEC will have to follow security sale rules similar to those SEC-regulated companies must obey. Scope of the rule will be broadened as more and more utilities complete compliance with the Holding Company Act of 1935 and pass from SEC jurisdiction to that of FPC. Written comments on the proposal will be accepted by FPC until March 1.

Depreciation Reserves and Expense—1948
By Accounting Method

Depreciation Method	No. of Utilities	Electric Plant		Depreciation Reserves		Depreciation Expense	
		Total (Thousands)	Depreciable* (Thousands)	Ratio to Total Plant	Ratio to Depreciable Plant	Ratio to Total Plant	Ratio to Depreciable Plant
Straight Line	191	$7,473,976	$6,374,115	22.6%	26.5%	2.30%	2.69%
Retirement	24	985,082	857,580	21.1	24.3	2.03	2.34
Interest	21	1,244,394	1,103,932	21.8	24.5	2.01	2.27
Revenue	13	1,080,567	956,331	22.3	25.1	2.70	3.05
All	249	$10,783,949	$9,291,964	22.3%	25.9%	2.28%	2.65%

* Total electric plant less items not considered subject to depreciation, such as land and land rights, intangibles, electric utility plant acquisition adjustments, construction work in progress, and plant held for future use.
Source: Federal Power Commission.

Straight Line Depreciation Methods Gaining Among Utilities, FPC Says

USE OF THE STRAIGHT LINE method of providing for depreciation is growing among the privately owned utilities.

At the end of 1948, 73% of Class A and B electric utilities had adopted straight line depreciation, a Federal Power Commission report shows. In 1945 the figure was 52% and in 1937, the first year for which such data are available, 15%. Several of the utilities now using other methods indicated in their 1948 annual reports that they are making studies with an eye to adopting straight line.

In other ways utilities are leaning toward the uniform system of accounts adopted by FPC and the National Association of Railroad and Utilities Commissioners.

An increasing proportion are segregating electric plant accounts, depreciation reserve accounts, and depreciation expense accounts from those covering other classes of property. At the end of 1948 more than 85% had completed segregation of property accounts, compared with 74% in 1945 and 51% in 1937. More than a third had determined annual rates of depreciation by property accounts and established reserves by functional classes of property.

Figures on 1948 depreciation reserves show that the average ratio of reserve to depreciable electric plant for companies using the straight line method was 26.5%, somewhat higher than was general among utilities using other methods (see table). Average annual straight line expense ratio was 2.69%. Companies basing their charges to depreciation expense on percentages of electric revenue had a higher rate of accrual than straight line companies last year, 3.05%. FPC attributed this difference to present favorable revenue-plant ratios and pointed out it did not necessarily reflect rates of accrual under operating relationships in more normal times.

Fuel and combination utilities generally showed a ratio of depreciation reserves to depreciable electric plant of between 20 and 29.9%. The greatest concentration of hydro utilities was in the group with ratios between 50 and 59.9% and that of the purchasing utilities in the 30 to 39.9% group.

Hydro companies reported the lowest ratio of depreciation expense to depreciable plant, generally between 1.5 and 1.99%. For fuel and purchasing companies the greatest concentration was between 2.5 and 2.99% and for combination utilities 2 to 2.49%.

Breaking their figures down by class of property, 97 utilities for which such data were complete reported an average reserve ratio to depreciable plant of 27.9% for steam property, 27.8% for hydro, and 15.2% for internal combustion. Corresponding expense ratios were 2.49%, 1.31%, and 3.68%. For transmission property reserve ratio was 29.5%, with 2.47% expense ratio, and for distribution 24.2% and 2.83%.

The study, entitled "Electric Utility Depreciation Practices, 1948" includes data on all Class A and B privately owned utility systems—those with annual operating revenues of $250,000 or more. These 315 systems account for 97% of the privately owned electric utility plants in the United States.

The report presents data on total and depreciable electric plant and on depreciation reserves and expense with appropriate ratios. Text tables show depreciation reserves and expense related to electric plant by depreciation method, by type of utility, and by functional classes of property together with average rates of depreciation by electric plant accounts and related data applicable in analyzing reserve and expense relationships.

Operating Revenues Up in November 1.9% over '48

Electric operating revenues of privately owned Class A and B electric utilities in the United States during November were 1.9% above the corresponding month a year ago, according to preliminary figures announced by the Federal Power Commission.

Revenues were $368,952,000 in November 1949, compared with $361,914,000 in November, 1948. Revenue deductions (including operating expenses, depreciation, and taxes) were $292,512,000, or 0.3% over those of November, 1948.

Gross income, including other utility operating income, amounted to $84,106,000, an increase of 7.9% for the month. Net income was up 8% to $62,219,000 from the $57,623,000 reported for the same month a year ago.

FINANCIAL BRIEFS

Stockholders of Bangor (Me.) Hydro-Electric Co at their annual meeting Feb 14 will be asked to vote on a proposed $5-million increase in the authorized capital stock. Addition of 20,000 shares of $100-par preferred and 200,000 shares of $15-par common would raise the utility's authorized capital to $17.5 million. They also will vote on limitation of the Series A 4% preferred stock to 17,500 shares and elimination of the authorized but unissued Series B 4% preferred.

Consummation of Part II of the trustee's plan for dissolution of International Hydro-Electric System has been ordered by the Federal District Court in Boston. The plan was approved by Securities and Exchange Commission in December.

Pennsylvania Power & Light Co has consummated a major step in its post-war financing program by selling to a group of institutional investors $33.5 million principal amount of 2¾%, 30-year first mortgage bonds on a 2.7% yield basis.

The plan for consolidation of Long Island Lighting Co with its two principal subsidiaries has been approved tentatively by the New York Public Service Commission. The Commission said final approval would be given after deficiencies amounting to about $10 million in the three companies' depreciation reserves have been eliminated. The plan has been approved by SEC and an order to enforce it is pending.

Output Breaks Another Record, Third This Year

Output turned upward in the week ended Feb 4, and it turned up to a new record, the third this year. The total was 6,062,095,000 kwhr, slightly more than the 6,041,158,000 kwhr reported for the week ended Jan 21. On a percentage basis for the United States the Feb 4 figure was 4.9% above that for the corresponding week of 1949.

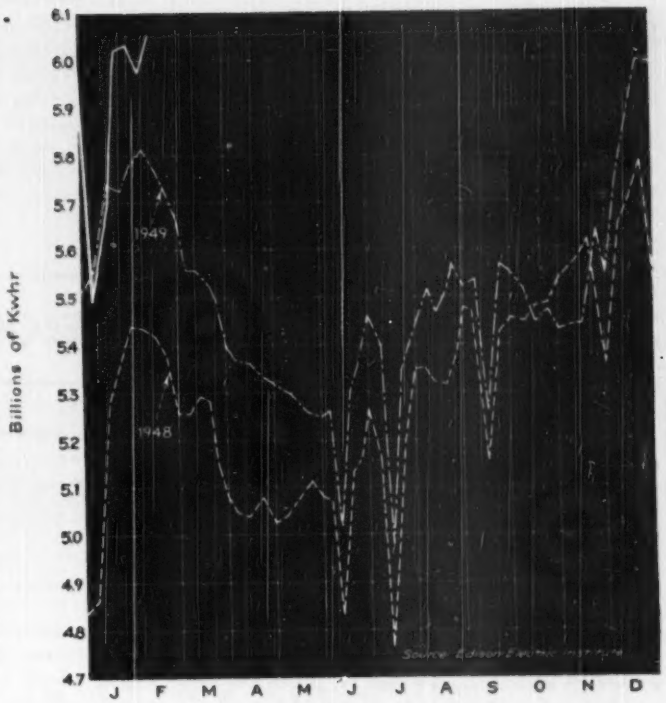
All regions were in the plus column, but the Central Industrial area made it by less than 1%.

Weekly Output, Millions Kwhr

1950		1949		1948	
Feb 4	6,062	Feb 5	5,778	Feb 7	5,412
Jan 28	5,972	Jan 29	5,810	Jan 31	5,429
Jan 21	6,041	Jan 22	5,769	Jan 24	5,436
Jan 14	6,029	Jan 15	5,727	Jan 17	5,370
Jan 7	5,695	Jan 8	5,742	Jan 10	5,278
1949		1949		1948	
Dec 31	5,493	Jan 1	5,562	Jan 3	4,868
1949		1948		1947	
Dec 24	5,994	Dec 25	5,508	Dec 27	4,826
Dec 17	5,997	Dec 18	5,790	Dec 20	5,361
Dec 10	5,881	Dec 11	5,705	Dec 13	5,327
Dec 3	5,743	Dec 4	5,646	Dec 6	5,218

Percent Change from Previous Year

	Feb 4	Jan 28	Jan 21
New England	+ 7.9	+ 7.8	+ 7.0
Mid-Atlantic	+ 1.8	— 0.1	+ 1.0
Central Industrial	+ 0.8	— 0.0	+ 2.4
West Central	+ 6.3	+ 5.8	+ 7.3
Southeast	+ 5.8	+ 3.9	+ 6.6
South Central	+13.3	+ 9.5	+ 8.6
Rocky Mountain	+ 3.0	+ 2.9	+ 2.7
Pacific Coast	+11.8	+ 6.9	+ 8.7
Total United States	+ 4.9	+ 2.8	+ 4.7



MEETINGS

Edison Electric Institute
Industrial Relations Committee, Palmer House, Chicago, Ill., February 16; Transmission and Distribution Committee, Statler Hotel, Detroit, Mich., February 20-21; Industrial Relations Committee, EEI headquarters, New York, N. Y., March 16, Netherland-Plaza Hotel, Cincinnati, Ohio, April 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 4-6; Purchasing and Stores Committee, Schroeder Hotel, Milwaukee, Wis., April 24-26.

Pennsylvania Electric Association
Transmission and Distribution Committee, Penn-Harris Hotel, Harrisburg, Pa., February 16-17; Joint Midwinter Meeting, Electrical Equipment Committee and Prime Movers Committee, Robert Treat Hotel, Newark, N. J., February 23-24.

National Adequate Wiring Bureau
Adequate Wiring Conference, Statler Hotel, St. Louis, Mo., February 16 and 17.

American Society for Testing Materials
Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa., February 27-March 3.

★**Interstate Power Club of New York**
Hotel Martinique, New York, N. Y., March 6.

National Rural Electric Cooperative Association
Annual Convention, Hotel Stevens, Chicago, Ill., March 6-9.

National Electrical Manufacturers Association
Edgewater Beach Hotel, Chicago, Ill., March 13-16.

Conference for Protective Relay Engineers
Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, Tex., March 20-22.

Southeastern Electric Exchange
Engineering and Operating Section, Bureau Vista Hotel, Biloxi, Miss., March 23-24; Annual Conference, Greenbrier Hotel, White Sulphur Springs, W. Va., April 12-14.

American Public Power Association
Annual Convention, Shoreham Hotel, Washington, D. C., March 28-30.

Missouri Valley Electric Association
Engineering Conference, President Hotel, Kansas City, Mo., March 29-31; Accounting Conference, President Hotel, Kansas City, Mo., May 18-19.

Midwest Power Conference
Sherman Hotel, Chicago, Ill., April 5-7.

American Society of Mechanical Engineers
Spring Meeting, Hotel Statler, Washington, D. C., April 12-14.

Northwest Public Power Association
Semi-annual Convention, Davenport Hotel, Spokane, Wash., April 17-19.

American Institute of Electrical Engineers
Power Conference sponsored by Committees on Power Generation, Industrial Power Systems, and System Planning, William Penn Hotel, Pittsburgh, Pa., I. Power Generation, April 19, II. Industrial Power System, April 20.

Electrochemical Society
Annual Convention, Statler Hotel, Cleveland, Ohio, April 19-22.

Oklahoma Utilities Association
Annual Convention, Biltmore Hotel, Oklahoma City, Okla., May 4-5.

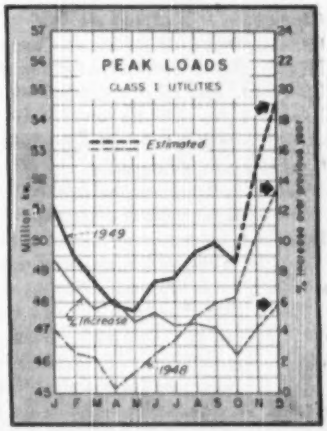
★ Addition This Week

Pay Raise Ends Strike

Employees of the Snohomish County PUD, Everett, Wash., are back on the job after a one-day strike. They have been granted a pay raise of 10¢ an hour. The men are members of the International Brotherhood of Electrical Workers, AFL.

New Monthly Chart Will Supply Peak Load Data

A new feature that will appear monthly in ELECTRICAL WORLD is the chart showing peak loads of Class I utilities. The chart is based on figures supplied by the Federal Power Commission. The estimates which make it the latest information available are by the Edison Electric Institute.



WASHINGTON COMMENT

RONALD D. ROSS

WHEN A CONGRESSIONAL committee meets in executive, or closed, session, some word of what goes on behind the closed doors occasionally "leaks" out. Sometimes, however, actions speak louder than any unpublished words. One such meeting recently may have far-reaching implications for the electric utility industry. What went on in the secret meeting became rapidly, if painfully, evident, although the actual dialogue still has not been put on the record.

Rural Electrification Administrator Claude R. Wickard went into conference with the House Appropriations subcommittee considering REA funds for the coming fiscal year with more than dollars on his mind. Mounting criticism of REA loans for co-op generation and transmission facilities to be operated by the Southwestern Power Administration had crystallized into a bill which would require Congressional approval of such loans.

Realization that a Congress which had grudgingly granted SPA transmission line construction funds last year might resent REA's pouring more millions of dollars into the controversial Interior agency's operations had REA worried. So worried, in fact, that for more than a month REA made no loans to "g & t's," which had been getting more than half the money approved by the lending agency in 1949. And the House subcommittee, headed by Rep Jamie L. Whitten of Mississippi, had made it clear that it wanted to talk to Wickard about REA-SPA transactions.

This formal inquiry was attended by the chairman of the House Appropriations Committee, Rep Clarence L. Cannon of Missouri. What Cannon and his colleagues told Wickard has not been disclosed. But it quickly became clear that the subcommittee wouldn't "shoot Santa Claus."

Day after the subcommittee session, Representative Cannon was at Wickard's elbow when the REA Administrator signed an $18 million-plus loan approval for N. W. Missouri Power Cooperative—a record high total for an REA loan. And other Congressmen from the Southwest beamed a few minutes later when Wickard formally okayed more than $12 million for Western Electric Power Cooperative in Oklahoma.

For REA, it was the lendingest day in history.

For SPA, it was three times as much money for power facilities as Congress had given it last year.

And for a sizable Congressional delegation, it was the stuff farm votes are made of in an election year.

REA's $30-million day indicated that all the stops are out. At least two more multi-million dollar loans soon will be approved with SPA contracts involved.

But the Southwest loans are only part of the "g & t" picture. In other areas super co-ops being formed are seeking huge loans for steam plants and transmission facilities. Many have been approved, but many more are coming. Fully half of all the loan applications now being considered by REA are for "g & t's."

Only development that could slow this unprecedented, taxpayer-financed power expansion would be firm Congressional action. A Fair Deal Congress in an election year is not likely to be that firm, judging by the performance of the House committeemen.

TECHNICAL NOTES

ARCHER E. KNOWLTON

National codes move faster toward municipal adoption in states where basic and permissive legislation has been sponsored and enacted.

Aluminum has been used in England for cable sheathing 1/3 as thick as lead and has saved as much as 65% of the overall weight of unarmored cable, 40% of armored.

Floating neutral is preferred for wyed capacitors because it avoids subjecting the units to abnormal line-to-ground stresses originating from lightning, switching, ground faults or phase unbalance.

Fires were extinguished in the Navy by "bean soup," a hydrolized protein made from soya bean and bubbly-aerated to flow and blanket flammable liquids afire. Industry is applying an automatic adaptation.

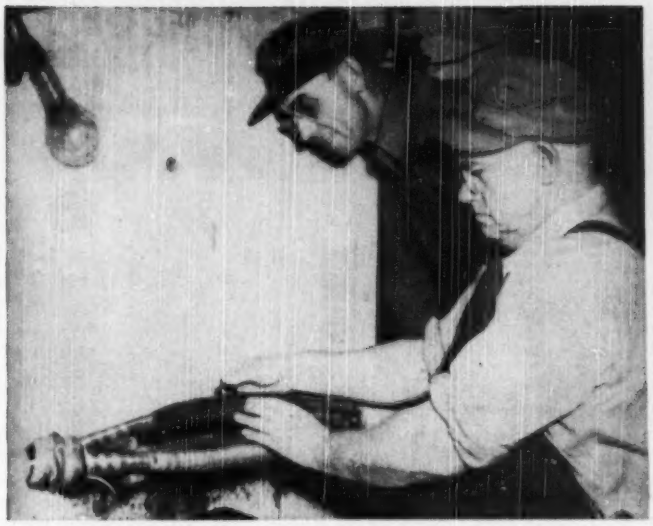
Fly ash from all the coal-burning power plants in the country amounts to something like 3,000,000 tons per year. It is bought at the price paid for coal and disposed of at an added cost that may reach $2,000,000.

Aluminum tubing, rolled or extruded shapes, should permit towers as strong as steel but at half the weight and without the cost of protective painting.

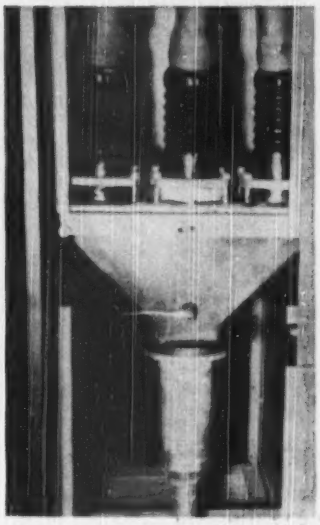
Carbonized current coils in watthour meters of early vintage are a sure sign of inability to meet modern customer loads. Why expect a 5-amp device to behave and survive on a circuit that today needs 20-amp protection?

Atomic energy, if, as and when, will resemble hydroelectric energy in that the costs are likely to be mostly fixed charges in both instances.

Hydrogen electrolyzed from water may be used instead of coke in blast furnaces. In an emerging process the hydrogen reduces the iron ore directly to sponge iron.



MAKING SPLICE in one of the gas-filled cables in manhole. "Pop" Pierce, at right, demonstrates splicing technique to his assistant, Clyde Winkle. After first two or three splices, each splice required approximately seven hours, which is comparable to the standard solid cable. New pressure type connectors were found superior to the solder type



POTHEADS used on gas-filled cable. Note flange construction for wiping sleeve at base of the pothead with connector above flange for installing supply line to the nitrogen

Why We Chose 15 Kv Gas-Filled Cable For Chemical Plant Feeders

Here's why two miles of gas-filled cables were selected for 15-kv parallel feeders at industrial chemical plant . . .

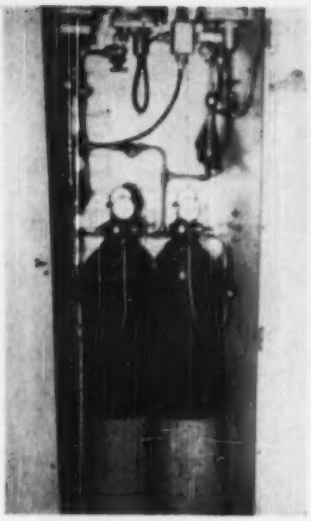
- **To provide supervised continuous service**
- **To give warning in case of cable sheath breaks**
- **Cable failure could cost $75,000 to $100,000 in materials and products loss in production**
- **Cost compared favorably with standard paper insulated lead covered cables of same voltage**
- **Installation and splicing time was only 15% higher than with standard solid type cable**
- **Permits one cable to be removed from service for checking or repairs**

ELECTRICAL ENGINEERING IN INDUSTRY

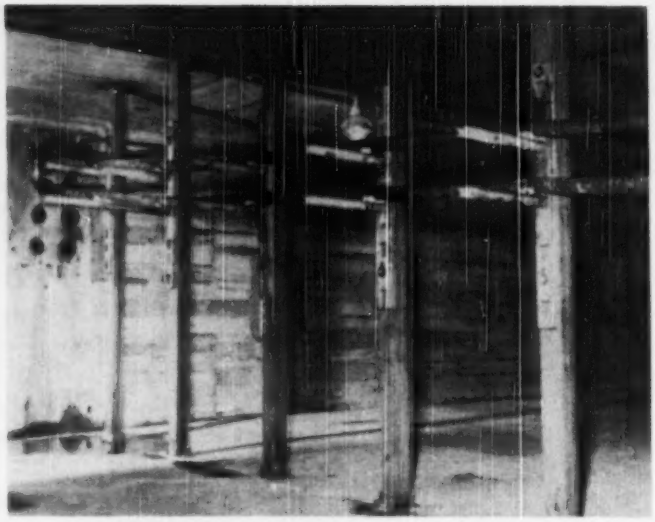
R. E. PHILBECK
Electrical Engineer
Tennessee Eastman Corporation
Kingsport, Tenn.

IN the fall of 1948 load conditions had developed to a point where it was necessary to install additional feeders to cover the increased load in the north section of the plant property of the Tennessee Eastman Corporation, at Kingsport, Tennessee.

It was decided at this time to install one 10,000 kva transformer, stepping down from 13.8 kv to 2,300 v, to feed an ever-growing substation which served this entire area at 2,300 v. Each building, or in some



INERT NITROGEN gas cylinders floating on line at 12 lb pressure. Three pressure relays interconnecting with a system of valves are installed above cylinders

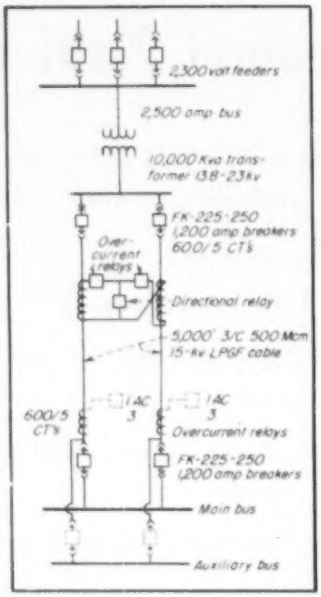


TYPICAL CABLE VAULT showing the two gas-filled cables. Seventeen manholes somewhat similar to this one are located in the 5,000-ft, 6 to 10-duct underground duct system connecting the north section of the plant with generating station No. 2. The gas-filled cable appears to have same physical construction as solid oil-impregnated type

cases groups of buildings, step from 2,300 v with their individual transformers to the operating voltage of 440 v. Due to the rapid growth and the inability to supply this increased demand, this transformer was originally fed with purchased power. Prior to the installation of the 10,000-kva transformer, power was fed to the north section of the plant from generating station No. 1, excess generating capacity being furnished from No. 2 to No. 1 station over a 6,000-kw tie line.

Due to overloaded cables, voltage regulation, and short circuit conditions, it was desided to transmit this power directly to the north substation by installing two parallel cables. Each would be capable of carrying the essential load in case an emergency should arise.

The decision at this time had to be made on the best type of cable to be utilized. Load conditions and the distance involved dictated the use of 13,800 v. What type of cable that would best stand the adverse conditions occasionally encountered in the underground duct system of this industrial chemical plant was still a problem to be decided. After a thorough study, low pressure gas-filled cable of the following specifications was decided upon: 3/C 500 Mcm Compact sector, with 130 mils paper insulation, shielding of 3 mils perforated copper band, overall binding of 4 mils commercial bronze, with an outer covering of 117 mils copper bearing lead. This cable was rated 15-kv grounded neutral.



RELAY and switchgear arrangement on the two gas filled cables feeding power from generating station No. 2 to the 10,000-kva transformer bank at north section of plant

It is very difficult to detect pinholes or small breaks in PILC cable soon enough after the break occurs to prevent a major cable fault. The first indication we have is an outage which may be very serious, especially so if supplying critical loads. Thus, for obvious reasons, this type of supervised cable gives us a means of detecting minor breaks before they can cause a serious outage. In some cases serious cable failures can cost as much as $75,000 to $100,000 in loss of materials in the process of production.

The major factors in making this selection were continuity of service, supervised cable for warning in case of any breaks in the sheath, and parallel cables each capable of carrying the essential load. For protective relaying, balanced power and overcurrent relays were installed. This selection gave practically 100% assurance of continued service, and at the same time allowed for one cable to be taken out of service for periodic checking and/or minor repairs.

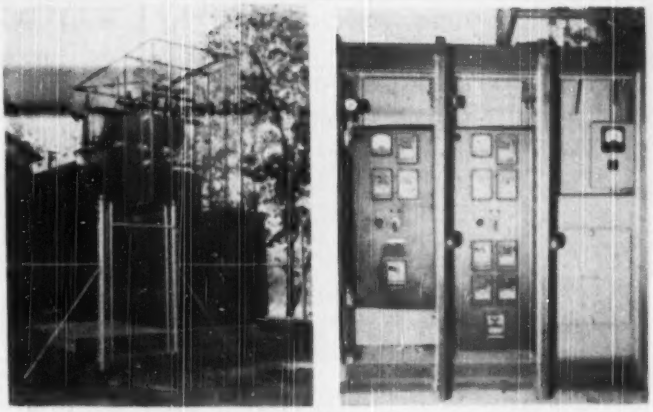
This installation consists of 2 cables routed through a 6 to 10 duct underground system, interconnected with seventeen manholes from gen-

erating station No. 2 to the 10,000-kva transformer in the north section of the plant. This covers a distance of approximately 5,000 ft.

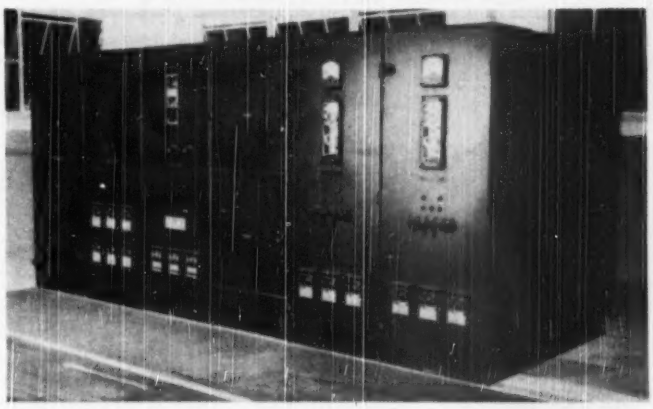
Construction Methods

The single line diagram indicates the breaker arrangements at the point of power generation, also breaker and bus connections at the 10,000-kva transformer station. The cable joints were made from a standard splicing kit. It was found from a series of tests that the new pressure type connectors were far superior to the old solder type split connectors previously used on solid type cable. On this installation a single 10-ton hydraulic ram press was used, compressing each cable connection to a pressure of approximately 8,000 lb gage. This work was decidedly speeded up over the older method and made a continuous piece of solid copper. Standard joints for this type of installation are 22 in. long, using a 4 in. diameter sleeve; but in order to speed up splicing time and allow ample room for good insulation, sleeves 26 in. long, 4½ in. diameter, $\frac{5}{32}$ in. thick were used. Cables terminated in the switchgear at each end in a special 15-kv pressure lug type pothead. The first splice made on this cable consumed approximately 14 hr; the next splice considerably reduced this time and was completed in about 12 hr. With approved technique after this job was started all joints were completed, excluding the pressure binding tape, in a matter of about 7 to 8 hr each. This time is comparable to the standard solid type cable.

At No. 2 generating station two nitrogen cylinders of 224 cu ft of free nitrogen capacity are floated on the line at 12 lb pressure. Connected into this 12 lb pressure line are two high and low pressure relays, with indicating lights and a warning horn installed at the switchboard operator's panel. At any time the pressure changes on the cables an indicating light indicates the cable affected and whether the pressure is high or low. The pressure will invariably rise due to an increase in load during the hotter summer months; whereas, during the winter when the ambient temperature is considerably lowered and load conditions in some cases drop, the pressure will drop in proportion. This change in pressure is rarely affected by any other than seasonal changes during the year, and very little time is involved in adjusting changes in pressure on the cable.



METALCLAD outdoor switchgear compartment serving the 10,000-kva transformer (in background of picture at left) at north section of plant. Gas filled feeder cables terminate in center and left panels (picture at right) which have over current and reverse power protection. Note cable pressure gage at top of each unit to indicate any plugging which may occur in cable; reading should check with gage in power house. Potential compartment at right has voltmeter and voltmeter switch for checking voltage on any phase



FEEDER BREAKERS for gas filled cable feeders are the two compartments at right of switchgear at generator station. Note transfer switches and indicating lights for the breakers; the lights indicate unit in which breaker is mounted, and whether closed or open

Considering the cost of standard cable, the cost for this particular installation of approximately 10,000 ft of gas-filled supervised cable compared very favorably with standard paper insulated lead-covered cable of the same voltage rating. Potheads for this installation were 300% of the standard potheads; splicing joints were same as standard units; and time required for installation was approximately 15% higher than would have been expected on a standard solid type cable.

This cable has been in service since January 1949 and has required little or no attention, and at the same time it stands as a sentinel over the essential power required in the north section of this plant. Any time, day or night, that a minor leak develops in the sheath an alarm is indicated. Corrections can be made at this time, or an increased flow of inert nitrogen gas will hold the cable in service until such time as the fault can be located and corrections made.

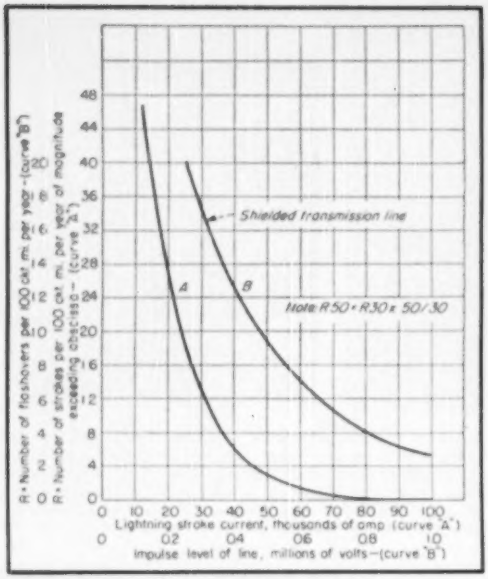

R = Number of flashovers per 100 ckt. mi. per year - (curve "B")
R = number of strokes per 100 ckt. mi. per year of magnitude exceeding ckt.cssa - (curve "A")
Shielded transmission line
A
B
Note: R50 = R30 x 50/30
Lightning stroke current, thousands of amp (curve "A")
Impulse level of line, millions of volts—(curve "B")

FIG 1—WEATHER BUREAU DATA can be used to adjust lightning probability curves (for isoceramic level of 50) for any area

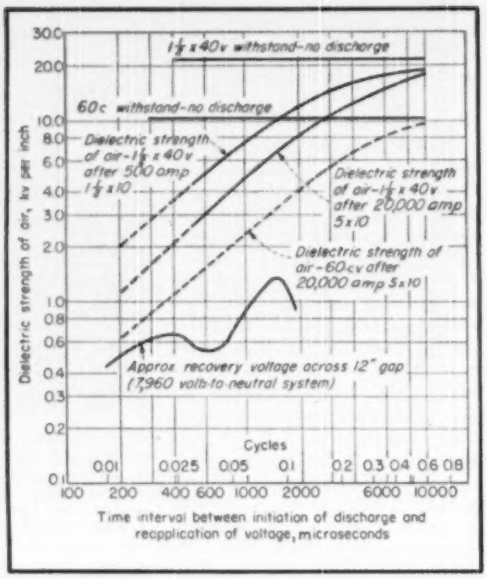

1½ x 40v withstand—no discharge
60c withstand—no discharge
Dielectric strength of air—1½ x 40v after 500 amp 1½ x 10
Dielectric strength of air—1½ x 40v after 20,000 amp 5 x 10
Dielectric strength of air—60-cv after 20,000 amp 5 x 10
Approx. recovery voltage across 12" gap (7,960 volts-to-neutral system)
Dielectric strength of air, kv per inch
Cycles
Time interval between initiation of discharge and reapplication of voltage, microseconds

FIG 2—DIELECTRIC RECOVERY of large air gaps, following discharge, varies with time interval, as shown in curves on this chart

Today's Lightning Knowledge Can

Reliability of distribution lines can be improved by adapting present principles of transmission lightning protection. Methods are outlined

JOHN P. BARRON
Electrical Engineer
Dallas Power & Light Co
Dallas, Texas

THERE is an unfortunate tendency to assume that economics prevent engineers from doing much about protecting distribution circuits from lightning. As a result most of the experimental work and resulting literature have been aimed at protecting transmission circuits. However, much of the work done primarily for transmission protection is applicable to distribution circuits. It is our* purpose here to present some of the presently advocated methods of protecting 11-13-kv grounded neutral circuits from lightning outages.

Data on the characteristics of lightning discharges, determined by laboratory and field studies in specific locations, have been compiled and published in the form of probability curves and expected performance charts. While transmission or distribution line performance is not subject to rigid calculation, estimates of performance must be based on lightning expectations in the area concerned. This requires accurate storm records on specific lines in the area over a period of years. In the absence of such records, data on thunderstorm days in a given area can be obtained from the United States Weather Bureau. Then, published lightning probability curves can be modified to approximate local conditions. Such a probability curve is shown (Fig 1).

Distance Provides Insulation

Design-performance charts for transmission lines show that economics prohibit using the insulation and spacing, on distribution circuits, that would prevent lightning from flashing over the insulation. Since it must be accepted that a high percentage of lightning strokes will flash distribution circuit insulation, the distribution engineer faces the problem of finding other methods to prevent ex-

* Recommendations and opinions presented are those of the author and do not necessarily represent the practices or policies of any organization, but are based on study of references, compilation of field information, and on the author's experience in this field.

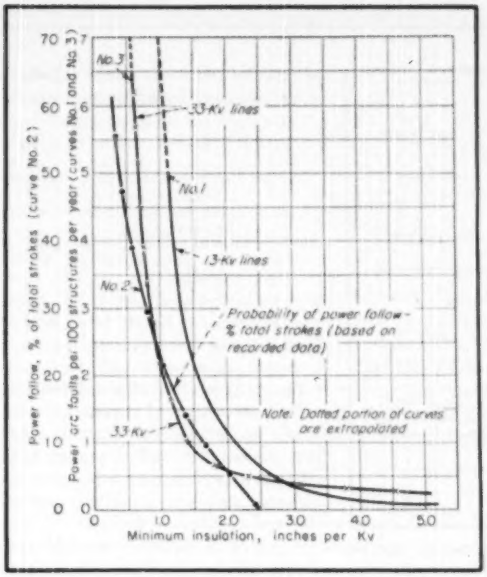

Power follow, % of total strokes (curve No. 2)
Power arc faults per 100 structures per year (curves No. 1 and No. 3)
Minimum insulation, inches per Kv
No. 3
No. 1
No. 2
33-Kv lines
13-Kv lines
33 Kv
Probability of power follow - % total strokes (based on recorded data)
Note: Dotted portion of curves are extrapolated

FIG 3—PROBABILITY of power arc following a lightning stroke decreases, as shown, as inches of insulation per kv increases

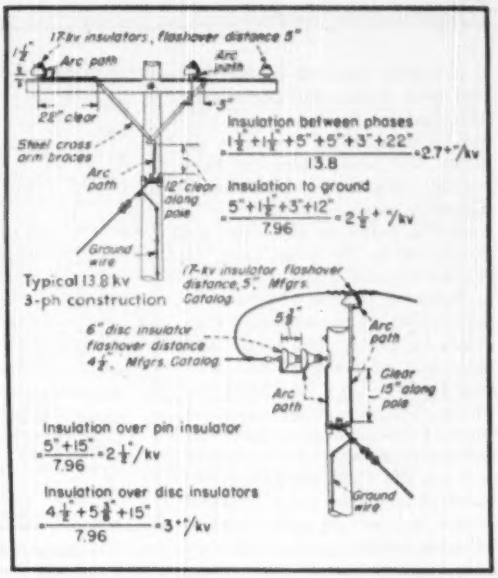


FIG 4—LENGTH OF ARC PATH can be calculated quite easily by following the path indicated on this typical 13-kv pole-top design

Improve Distribution Line Design

cessive circuit faults due to lightning flashover.

Several excellent investigations have determined that wood has an approximate impulse strength of from 50 to 100 kv per ft, depending on moisture content. On distribution circuits, where there is about a one foot length of wood in series with the conductor insulation, the impulse level of the circuit is raised considerably percentage-wise. However, it is seldom possible to include sufficient wood in series with the insulation normally encountered on distribution circuits to reduce lightning flashovers materially.

Experiments show that when a typical distribution circuit is flashed by lightning or a surge generator, the discharge follows the surface of the pin or disc insulator, wood crossarm and pole, leaving a path of ionized air through which the power follow current travels, causing a fault. The frequency of occurrence of power current following flashover has been shown to decrease as the length of the ionized path increases. Thus, increasing the length of wood in series with conductor insulation decreases the number of faults more than is indicated by the additional impulse strength. Experiments explain this behavior.

It is known that probability of restrike, or power follow in air following a discharge, is determined by the relation between the dielectric recuperative rate of air and the magnitude and rate of rise of the voltage applied after the initial discharge. The magnitude and rate of voltage rise on a distribution line can be determined by an ultra-high speed oscillograph. Recuperative rate of air, following a discharge, is dependent on several variables: Duration of discharge, current in discharge, wave shape of discharge, length of arc, and moisture content of air.

Dielectric strength of air following discharges approximates the values shown on the curves (Fig 2). Dotted portions of these curves have been extrapolated, and the 60-c dielectric strength curve is approximate only, and should be used as an indication rather than for computation. To Fig 2 has been added a recovery voltage curve which can be considered severe for distribution circuits.

It can be seen from Fig 2 that, following a discharge, the dielectric strength of air is only one-third normal at 0.1 c, and is very nearly normal at 0.5 c after a severe discharge. Also, following a short circuit, the natural oscillation of the system will reach its first peak voltage near 0.025 cycle and its peak voltage near 0.1 cycle after the short circuit is released. To protect the circuit against restrike at the first voltage peak, with a factor of safety of two, the length of the arc path along which power follow current must travel should be such that the air will not be worked at more than 0.4 kv per in.

This is substantiated by the work

of Bellaschi, reported in the July 1947 issue of *Electrical Engineering*. Also, field tests by Philadelphia Electric Co, reported by Ekvall in the March 1941 issue of *Electrical Engineering*, indicate that increases in insulation (arcing distance) up to about 2 in. per kv for 33-kv lines, and 3.5 in. per kv for 13-kv lines, are effective in reducing power faults due to lightning. Results reported by these studies are approximately those shown by Fig 3. Recent spot field inspections of insulators and insulator hardware on a 7.6/13.2-kv system revealed no indication of power current following flashover where the flashover distances were 2 in. per kv or better. At 1½ in. per kv approximately 5% of the poles inspected showed evidence of power current following flashover, and at 1 in. per kv or less, approximately 70% of the poles inspected which were not protected by arresters showed evidence of power current damage.

From these studies it is fairly well established that power faults following lightning discharges can be reduced materially by constructing distribution circuits so that the arc path is of sufficient length that the air will not be worked at voltage gradients exceeding 0.5 kv per inch, and that benefit can be obtained by reducing voltage gradients to as low as 0.3 kv per inch. Length of the arc path for this purpose is calculated as the flashover distance of the insulator or insulators, plus the shortest path along the surface of the wood pole or crossarm. The resulting arc length divided by the normally impressed voltage gives the insulation level in the convenient term of inches per kv. In figuring the arcing distance of disc insulators in series, the arcing distance of one insulator plus the center to center separation of insulators is used as being most representative of the actual arc path length. Figure 4 shows some typical 13-kv distribution circuit construction, indicating the normal arc path, and showing the method of calculating the length of the arc path.

The problem of building insulation of 2 in. per kv or better into new distribution circuits, while relatively simple from the design point of view, is not quite so simple in the field. It requires the education of the construction forces. Also, it requires close inspection of the completed construction by competent engineers, as well as a policy that allows the engineer to order corrections immediately when found necessary. Rebuilding existing circuits to obtain the desired insulation level is a matter of policy and economics. It can be expensive, requiring pole replacement and circuit rearrangement. It may be entirely desirable to rework circuits in high load density areas where the number of customers affected by an outage is high, and not desirable to rework circuits in low density areas. However, the importance of this phase of the protection of distribution circuits from outages due to lightning can hardly be over-emphasized, since it starts at the source of line protection by decreasing the number of faults that occur.

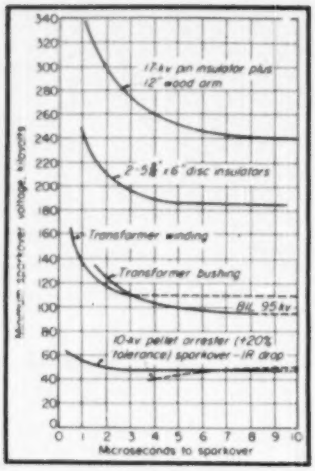

Minimum sparkover voltage, kilovolts
Microseconds to sparkover
17-kv pin insulator plus 12" wood arm
2-5⅜" x 6" disc insulators
Transformer winding
Transformer bushing
84, 95 kv
10-kv pellet arrester (±20% tolerance) sparkover - IR drop

FIG 5 — COORDINATION OF EQUIPMENT is possible when their impulse characteristics are known. Typical values are shown for 13-kv distribution line materials

Arresters For Line Protection

Use of lightning arresters solely for *line* protection on distribution circuits is difficult to justify. However, the additional protection afforded the circuit by arresters installed primarily as transformer protection is a desirable bonus and should be taken advantage of wherever possible. By using the formula

$$E = E_s + 2\,de/dt \times L/1000 \quad \text{(up to } 2\,E_s\text{)}$$

where

E = Voltage at a distance L feet from a lightning arrester,
E_s = Voltage at which arrester will discharge, and
de/dt = Rate of voltage rise of lightning wave front in kv per microsecond,

the voltage due to lightning at a given point on a circuit protected by arresters can be approximated.

A few calculations will show that complete protection of a distribution circuit by means of arresters could hardly be justified. It is recommended that arresters be used to protect specific equipment such as transformers, airbreak switches, important buses, etc, and to prevent flashover of the line where it is not practicable to obtain sufficient insulation to prevent power follow current. Another recommended use of arresters is to protect fuses in lateral circuits from lightning strokes on long main lines by installing an arrester one span away from the lateral tap on both sides of the tap.

Protection of Transformers

On a distribution system, transformers are the most expensive equipment, and in recent years have been the most difficult equipment to replace. The installation of an arrester for the protection of a transformer adds a small increment to the installation cost. For example, a 10-kv arrester for the protection of a 5-kva, 7,620-v transformer adds approximately 10% to the job cost. This increment of cost decreases as the transformer size increases, being less than 4½% for a 25-kva transformer. In addition to the protection afforded the transformers, the arresters also reduce the number of line flashovers due to lightning, thus reducing materially the number of faults and outages on the circuit.

Selection of arrester voltage rating is determined by the circuit voltage and by the effectiveness of the system grounding. Arresters are rated according to the maximum power voltage at which the arrester will interrupt the power current which follows discharge. If a system is solidly

grounded, arresters with a rating slightly in excess of the system line to neutral voltage can be used, and a considerable saving in money as well as increased lightning protection can be realized. If the system is ungrounded, or grounded through a high impedance, it is necessary to use arresters rated at system line to line voltage. It is recommended that calculating board studies, together with actual tests, be made to determine the effectiveness of system grounding and the magnitude of voltage displacement during fault and that arresters be selected accordingly.

In order to coordinate flashover characteristics of distribution transformers with as great a margin of safety as possible, it is recommended that the lowest voltage arrester consistent with the characteristics of the system be selected. Figure 5 shows a typical coordination chart of various distribution line materials commonly found on 13-kv distribution systems, and the characteristics of a 10-kv valve type arrester.

It should be remembered that in addition to the IR drop through an arrester the IZ drop in the arrester ground lead must be taken into consideration. This is particularly true of valve type arresters since the IR drop across the arrester is quite high during high current discharges. Arrester ground leads should be connected to the system common neutral where available, and, where a multigrounded common neutral is not available, to as low impedance ground as is economically practicable. Otherwise, during high current discharges the voltage across the arrester plus ground impedance may exceed the insulation level of the transformer to be protected.

Arrester Discharges and Fuse Blowing

Transformers are customarily fused for protection of the transformer from excessive damage due to faults inside the transformer or on the secondary side of the transformer and from damage due to overloads. In applying arresters to fused transformers, it is extremely important that the arrester be connected on the line side of the transformer fuse. Otherwise, the fuse may be blown by the arrester discharge and service interrupted unnecessarily. Figure 6, which is a combination of published probability curves of the duration of arrester discharges and the current characteristics of commercial fuses, shows the probability of several sizes of fuses being blown due to arresters discharging lightning current through the fuses.

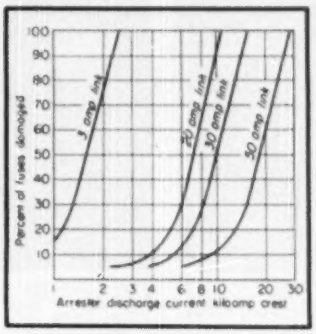


FIG 6—PERCENTAGE of fuse links of the cable-type that would be damaged by an arrester discharging through the link is shown on the accompanying curves

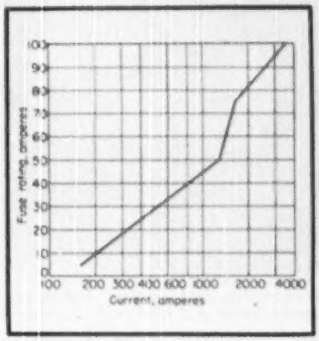


FIG 7—FUSES may be damaged within one-half cycle by current values shown on the accompanying curve for 100%-rated fuses. A 25% safety factor has been assumed

Expulsion type arresters allow the power current to flow for ½ cycle after discharge. It is the opinion of some engineers that expulsion type arresters, exposed to frequent operation and high fault current during discharge, will deteriorate to such an extent that the power current following a discharge may be allowed to flow for several cycles. Field data available do not show this to be the normal case. Systems equipped with expulsion type arresters, which are experiencing numerous unexplained interruptions during lightning storms, would do well to check such arresters which have been in service several years. Until there is definite field information to the contrary, it is the opinion of the author that it can be assumed that under duty for which the arrester has been designed, expulsion arresters interrupt power follow current in ½ cycle. Figure 7 shows approximate power follow current of ½ cycle duration necessary to damage commercially available, 100%-rated fuses. With the arrester connected to the line side of the transformer fuse, the fuse is not affected by arrester discharge currents or power follow currents. On a system using fuses for line sectionalization, the arrester currents may determine the smallest useable fuse size.

Gaps Offer Low-Cost Protection

Some organizations, employing a rapid-trip, rapid-reclose scheme to reduce the effect of faults, have employed spill-gaps for transformer protection. A spill-gap is an air gap with metal electrodes, one connected to transformer lead and one grounded, spaced so that the impulse level of the gap is below the impulse level of the transformer. When a lightning surge hits the transformer the gap sparks over discharging the surge to ground. The lightning discharge almost invariably causes a power arc across the gap which continues until the circuit is de-energized. Then the arc extinguishes and the circuit may be re-energized to restore service.

Where policy concerning quality of service will permit, the use of this scheme of protecting transformers may result in some saving. Spill-gaps may be particularly applicable in low load density areas where costs must be kept to a minimum. Experience has proved, however, that where a number of spill-gaps are employed on a circuit, or a section of a circuit supplying a large number of customers, the number of customer interruptions, although momentary, can become extremely burdensome.

(Continued on page 155)

H. H. Henline, AIEE Secretary; A. E. Knowlton, "Electrical World", General Chairman of Meeting; Dr. Vannevar Bush, Carnegie Institute

R. W. Wilbraham, United Engineers & Contractors, Inc; Stanley Stokes, Union Elec. Co of Missouri; Wade Burleson, Ohio Brass

Industry Techniques Advanced in AIEE

HEAVIER IN technical content than any previous meeting the Winter General Meeting of the American Institute of Electrical Engineers in New York January 30 to February 3 attracted over 3,250 members and guests. That the sessions added much to the technology of several branches of the art is attested by such discussions as those of system stability under the leading power factor imposed by growing cable and capacitor systems, the desirability of reframing the basic impulse insulation pattern, the progress in electronic drives for heavy industry and the success of electronic excitation for large generators. Among other topics discussed actively were the impediments to acceptance of long-tube cold-cathode fluorescent lighting, the amelioration of transformer noise, the clarification of the problem of cable loading temperatures and the relative virtues of high frequency and resistance heating for electrolytic tin plate and strip galvanizing. Still other topics were the merits and limitations of centralized station control and the recent improvements in bushing-type current transformers.

CENTRALIZED STATION CONTROL

Design and Operation of Central Control Rooms. B. F. Borgel, *Pennsylvania Electric Co*

Experience with central control room at Warren Station points up desirable basic changes in board arrangement for maximum ease of operation. Lighting and visibility of plant for control room are related.

Centralized Instrumentation and Controls For Steam-Electric Power Stations. B. C. Mallory, *Stone & Webster Engineering Corp*

Comparison of four stations with differing amounts of centralized control. Author concludes that in new single unit station electrical control room, boiler and turbine gage boards may be centrally located. As units are added best scheme is separate electrical control room, immobilized steam board operator for each turbine-boiler and auxiliary mobile operators.

A. H. Burkhalter, Ebasco Services, described several recent control boards incorporating Borgel's recommendations based on Warren Station experience. They used airplane-type instruments and low-pressure gages. C. P. West, Westinghouse Electric Corp suggested that 4-in. switchboard control and instrument gages give the best arrangement. Smaller instruments are less accurate and hard to read, he said.

Frank V. Smith, Sargent & Lundy, noted that the only serious threat to centralized control lay in a disaster involving the central point. The best location for central control, he felt, is between boiler and turbine in stations up to 30,000 kw. In larger multiple-unit stations, complication forces compromise and some segregation even at a sacrifice to building size. Fred Fairchild, Public Service Electric and Gas, said the rotation of operators on mechanical and electrical controls in the centralized control room at Sewaren has produced better operators and been an excellent training for system operators.

John M. Drabelle, Iowa Electric Light & Power Co, stating the case for centralized control in small central stations, pointing out that its use is highly economical because labor is a larger proportion of operating cost in small plants. N. E. Funk, Philadelphia Electric Co in accepting this premise, pointed out that in larger stations it was not such an open and shut case. With four or six machines on one bus, it is possible to gather more information at one point than the human brain can encompass in emergencies and act properly.

POWER SYSTEMS

Audience attention given the amazing array of eleven conference papers on operation of utility systems at leading power factor, Thursday afternoon, testified to the interest that the subject holds today.

R. F. Lawrence and J. E. Barkle, Westinghouse, demonstrated that the Potier-voltage method of determining pull-out power gives results that are closer to the true value than other methods.

T. B. Montgomery and H. W. Cory, Allis Chalmers, described a device for maintaining minimum excitation on a generator at any margin above that

E. E. George, Ebasco, N. Y.; W. R. Brownlee, Commonwealth Services, Jackson, Mich.; H. A. P. Langstaff, West Penn Power Co, Pittsburgh

J. R. North, Commonwealth Services, Inc; T. G. LeClair, Commonwealth Ed., AIEE president nominee; R. T. Henry, Niagara-Mohawk

Winter General Meeting Sessions

required for generator stability at any load. It comprises a circuit for measuring in-phase component of line current and comparing it to actual excitation current.

E. L. Michelson, Commonwealth Edison Co, said that extensive use of high voltage cable and static capacitors on the Chicago system accounted for the high power factor of that system at light loads. He outlined studies that led to installation of loss of field protection on generators.

Two years of favorable experience with low limit excitation control at Missouri Avenue station of the Atlantic City Electric Co was detailed by W. E. Caven in a joint paper with F. S. Rothe, GE. The scheme permits var generation over a range not formerly considered good practice.

EXCITATION SYSTEMS

Excitation System Performance With Motor-Driven Exciters. A. G. Mellor and M. Temoshok, *both of General Electric Co*

Emergency throw-over times for exciter motor of 1-2 sec found to give substantial margin in system performance. For 3-ph short circuit at generator terminals maximum permissible switching time approaches critical switching time of 11-20 c.

Design and Test On Electronic Exciter Supplied from Common Shaft Driven Generator. A. P. Colaiaco, A. A. Johnson and J. E. Reilly, *all of Westinghouse Electric Corp*

Laboratory and field tests verified by one year service record indicates electronic exciter supplied from separate ac generator (to be free of system disturbances) is giving satisfactory excitation for normal and system fault conditions. Cost is 2 to 3 times that of conventional exciter.

Excitation Improvement—Electronic Excitation and Regulation of Electric Generators As Compared to Conventional Methods. A. H. Phillips, Gilbert Associates and W. H. Lambert and D. R. Pattison, *Pennsylvania Electric Co*

Year's performance of electronic exciter voltage regulator combination at Warren Station of Penelec establishes points of operating superiority over conventional exciter systems. Demonstrates ability to ride out system disturbances.

Favorable experience with electronic exciter systems was presented by discussers from two major power systems. J. H. Kinghorn and F. M. Porter, American Gas & Electric, summarized favorable experience with 63 machine-years of electronic pilot exciter performance and 41 machine-years with electronic main exciters. Principal troubles involved erosion of firing igniters, cooling and conductivity of cooling systems. In the last four years, practically no changes have been made on the three installations involved. A total of 32 thyratron tube failures have occurred. Tube life has been 12,500, 11,800, and 26,600 service hours respectively. Kinghorn and Porter however, were unable to agree that direct-connected machines are as unreliable as painted in the Phillips, Lambert, Pattison paper. H. A. P. Langstaff, West Penn Power Co, stated that direct-connected exciters are not as reliable as either m-g set or electronic exciters. Troubles with cooling system pumps, similar to those at Warren, were had at Springdale. Life of thyratrons average 1½ years. Loss of vacuum was major cause of replacement. In three years, so far, West Penn has never lost a generator due to electronic failure, Langstaff reported.

CABLES

The Thermal Resistance Between Cables and a Surrounding Pipe or Duct Wall. F. H. Buller, *General Electric Co* and J. H. Neher, *Philadelphia Electric Co*

Extends to oil and gas the heat flow relationships established for paper by Neher earlier this year and embraces convection and radiation as well as conduction. Surface resistivities of 350, 450 and 800 found for oil, gas (200 psi) and air respectively.

Development of Improved Luminous Sign Cable. L. F. Roehmann and E. W. Greenfield, *both Anaconda Wire & Cable Co*

Flame-resistant polyethylene-derived insulation or jacket found superior in tracking resistance when subjected to alternate salt and fresh water sprays.

Terminals and Joints for Insulated Power Cables. L. F. Roehmann, *Anaconda Wire & Cable Co*

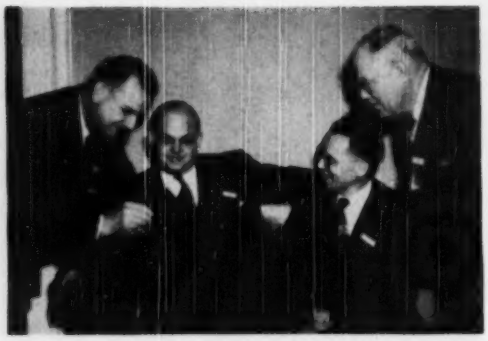
A helpful elucidation of the radial (good) and tangential (poor) dielectric strengths which dictate effective cable splices and terminals.

Heat Transfer Study on Power Cable Ducts and Duct Assemblies. P. Groebler, *Johns-Manville* and G. F. Barnett, *Philco*

Results of 11-year laboratory study shows relative thermal resistance of duct materials.

Technique employed in the Johns-Manville tests was regarded highly by

Mark Eldredge, Munitions Board; G. M. Armbrust, Commonwealth Edison; "Irish" Kennedy, Joslyn, Chicago; H. W. Lovett, Roller Smith



E. C. Starr, Oregon State College; R. R. Crow, Richland, Wash; P. L. Bellaschi, Portland, Ore; N. B. Hinson, Southern Cal. Edison Co

the discussers with the suggestion that further studies could well employ cables of smaller diameter; also that moist fiber duct would probably show heat transmission intermediate between dry fiber and the mineral types of duct wall. R. W. Burrell (Consolidated Edison) pointed out that the IPCEA data lacks the flexibility for comparing alternative designs but R. J. Wiseman (Okonite) gave assurance that the duct constants were being studied to recognize the differences in duct wall materials. R. W. Atkinson (General Cable) questioned the pertinence of duct air temperature because it could only be some kind of average between sheath and duct wall temperatures. Consensus of all discussions is that the next move is to extend the studies to multiple duct banks in earth—the real crux of cable loading limitations.

SYMPOSIUM ON RELAYS

Consideration of Requirements and Limitations of Relaying and High Speed Reclosing on Long and Heavily Loaded Transmission Lines. C. E. Parks, *Public Service Co of Indiana, Inc* and W. R. Brownlee, *Commonwealth Services, Inc*

Combined Phase and Ground Distance Relaying. Warren C. New, *General Electric Co*

New relaying system that provides phase and ground distance relaying protection for transmission lines requires less equipment than six directional-reactance distance relay scheme usually applied. Avoids objectionable switching schemes used to select faulted phase—current or potential.

Sensitive Ground Protection Project Committee of AIEE Committee on Relays

Methods for sensitive ground relaying of three phase distribution and transmission systems analyzed. Limitations indicated for known protection systems for three phase four wire multi-grounded systems.

Fully as much interest was evidenced in the group of three papers on relay protection of short, medium and long transmission lines as when they were presented in preliminary form, two years ago. The most frequent discussion comment was that variations from the hypothetical system might alter the solutions selected. A. J. McConnell, G. E., said this was particularly true for short and medium length lines. They suggested also that high speed bus differential protection and transfer switching might have been considered in the Kinghorn paper. C. E. Asbury, Consumers Power, in a detailed examination of the same paper saw need for some definition of a "typical system". He observed that a different distribution of load and generation of the system would have given different answers.

Where pilot wire is already used for supervisory control, this type of relaying can be added at little extra cost L. L. Fountaine, Westinghouse, pointed out in comment on the paper by Mater. Whether protection is lost when a pilot wire is taken out of service depends on the type of relay used. Some relay schemes provide protection under such circumstances, he said.

Discussing the paper by New, C. A. Streifus, Ebasco Services, pointed out that the combination described does not give third zone backup protection for faults in the direction opposite to that in which the relays are pointed. C. W. Frederickson, Commonwealth Services, pointed out that the scheme described does not reduce the number of elements required, compared with separate phase and ground distance relay systems. Moreover, setting and testing is somewhat more difficult and savings in installed cost are not great.

TRANSFORMER PROTECTION

Margins Between Arrester Protective Levels and Transformer Insulation. F. J. Vogel, *Illinois Institute of Technology*

Commercial tests put arrester in more favorable light than transformer. Steep front strength in transformers desirable. Ground wire, small surge currents warrant reduced transformer insulation.

Lightning Arresters as a Criterion for Insulation Levels. H. L. Rorden, *Bonneville Power Administration*

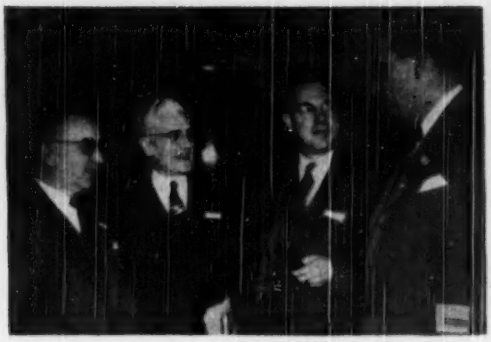
Costs related to BIL. If arrester levels can be reduced BIL and costs of transformer and breakers can also be reduced.

Application and Handling of Very Large Power Transformers. R. F. Stevens, *Bonneville Power Administration*

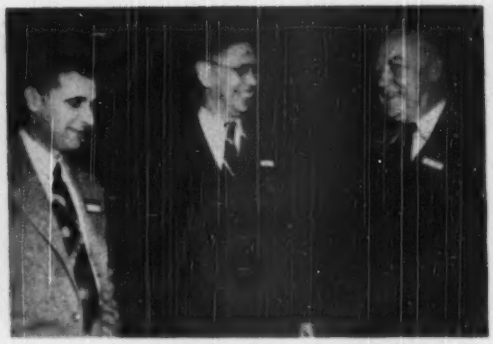
Explains reasoning behind adoption of 900-kv impulse level and advocacy of 800 kv as well as tricks in handling and economical application of spares.

Proposed Changes in Methods of Making Temperature Rise Tests on Transformers. Committee report.

Keynote of this session was the concept that basic impulse insulation level for transformers was set too high for grounded systems. Rorden, in detailing his paper, suggested there could well be two sets of BIL, one for effectively grounded and another for ungrounded systems. The dollar volume lies in the grounded category, he said, adding that Bonneville Power Administration could have saved $200,000 on a $900,000 purchase of a 230-kv, 230-Mva bank by adopting a 75% BIL instead of the full 1,050-kv impulse strength. His data sup-



E. V. Sayles, Consumers Power Co; E. S. Fields, Cin. Gas & Elec. Co; F. E. Sanford, Commonwealth Services; A. C. Monteith, Westinghouse



J. G. Yevick, Pepco, Washington, D. C.; E. R. Thomas, Consolidated Edison Co of New York; H. E. Yeide, Pepco, Washington, D. C.

ported the assertions. Further, there was a 63 to 100% spread in bids on a nominal 75% BIL design with a spread of 11% in the actual BIL built into the units.

TRANSFORMER NOISE

Audible Noise of Power Transformers. T. G. Gordy, *General Electric*

Magnetostriction, core gaps and joints, core-coil reaction, coil vibration are sources varying with design and loading. Low-noise-level designs are costly and so are enclosures. Compromises necessary.

Harmonic Index—A Tool for Transformer Audio Noise Investigation. W. H. Mutschler, Jr. and T. F. Madden, *both Allis-Chalmers*

Argues value of index which is decibel difference between "flat" weighting noise and that with 40 db weighting.

Audio Noise in Transformers in Residential and Commercial Areas. C. E. Baugh, *Pacific Gas & Electric Co*

Cold-rolled steel cores and higher flux densities warrant reopening 1938 conclusions. NEMA standard deemed too liberal. Enclosure hardly feasible. Resilient pads not effective. Ear differs from acoustic instruments.

In a conference paper A. J. Maslin (Westinghouse) asserted that vibration absorbers between the transformer and the foundation are effective only when the foundation transmits vibrations to another sound radiator; also that roofless and partial enclosures are relatively ineffective at a considerable distance because of diffraction at the edges. He added that the increase in cost of a transformer for a given reduction in noise below standard levels is greatest for the small and medium sizes of power transformers. Detroit Edison uses masonry wall enclosures with removable panels and, according to I. S. Mendenhall and F. L. Taylor, the order of effectiveness of the panels is: (1) masonry block, (2) glass fibers, (3) ribbed sheet steel. In discussion, Lloyd F. Hunt (Southern California Edison) made the point that there was not much sense in buying factory assembled unit substations to avoid the necessity of erecting a building only to find that it is virtually necessary to erect the building anyhow to house the noise.

LARGE ELECTRONIC D-C MOTOR DRIVES

Large Electronic D-C Motor Drives in Industry. M. M. Morack, *General Electric Co*

Suitable rectifying devices and power circuits have been developed which have overcome previous difficulties and now permit a new approach to the problem of adjustable speed and motor drives for industry.

Control of Large D-C Motors Supplied From Ignitron Rectifiers. O. W. Livingston, *General Electric*

Closed loop or feedback system is highly desirable but requires use of some form of amplifier between reference and comparison circuit and ignitron phase shift system. Three different systems involving use of amplidynes, electronic amplifiers and amplistats have been successfully built to serve this function.

Rectifier Equipment for Electronic D-C Motor Drives. M. J. Mulherne and S. N. Crawford, *both of General Electric*

Paper gives functional description of adjustable voltage rectifier equipment which delivers moderate power and is suitable for the control of one or more dc motors. 550-v, dc selected for best economics supplied from standard 3-ph distribution system of 460v.

Application of Electronic Motor Drives to Printing Presses. J. A. Johnson, *Times-Mirror* and E. M. Stacey, *General Electric*

Printing presses are sound field for application of electronic motor drive both from functional and reliability standpoint. Drive can be justified economically in most metropolitan areas.

Electronic d-c motor drives up to 600 hp have been installed as main roll drives in steel mills. Rectifier equipment included 12-ph, 1,200-kw and 6-ph, 1,500-kw ignitron units. One hot strip mill installation has two 5,000-kw 12-ph rectifier units. Power required for regulation of these units is only 100-kw—less than that required for a generator exciter. Regulation is simple and accurate.

A Mexican sugar mill now uses a 1,200-kw and a 2,500-kw rectifier unit in bringing rolls up to speed. In France, a 15,000-kw unit is used for 700-v direct current in a hot strip mill. Other foreign orders for rectifiers include one 15,000-kw and one 18,000-kw unit.

The Los Angeles Times-Mirror saved $15,000 on air conditioning equipment alone in installing their rectifier. Four metropolitan newspapers are now using 28 ignitron rectifiers to operate 5,000 hp in motors for their presses. Eight newspaper publishers now have orders in for 16 rectifiers to run 3,000 hp in motors.

SWITCHGEAR

High Voltage Oil Circuit Breakers for 5,000,000 to 10,000,000 Kva Interrupting Capacity. W. M. Leeds and R. F. Friedrich, *both Westinghouse Electric Corp*

Design features for breakers rated 5,000,000 and 10,000,000 kva. Methods of verifying capacities in manufacturers high power laboratories and by field tests on customers property outlined. Test results given.

New Grounding and Testing Device for Metal Clad Switchgear. H. Krida and E. T. McCurry, *both General Electric Co*

Device interchangeable with and using

W. M. Edmunds, REA; I. F. Conrad, GE; J. B. McCurley, J. E. O'Brien, both of REA; F. W. Willcutt, Pepco; all from Washington, D. C.

John W. Butler, GE, Pittsfield, Mass. E. F. W. Alexanderson, GE, Schenectady; C. B. Kelley, United Light & Railways Co, Des Moines

elevating mechanism of circuit breaker in metal clad gear brings out connections to bus and feeder for easier, safer testing and grounding of power circuits.

Development and Testing of and Improved High-Voltage, High-Capacity Impulse Breaker. E. B. Rietz, *General Electric Co*

Laboratory and field tests show impulse type low-oil-content circuit breaker capable of meeting all requirements desirable in a circuit breaker for protecting higher capacity power systems of future.

Outdoor Metal-Clad Switchgear. P. R. Pierson, *Westinghouse Electric Corp*

Discussion of the application and use of metal-clad switchgear for outdoor installations. Advantages, conditions that require special consideration.

Universal praise for improvements incorporated in the Krida-McCurry grounding and testing device was mixed with comments from sundry discussers that it was "unnecessarily complicated", cumbersome to use in an emergency, and that it lacked certain safety features that might have been included.

Most frequently repeated criticism, however was that necessity of removing the device to recharge the spring-operated mechanism was a handicap.

B. I. Hayford, Westinghouse, felt that combination of grounding and testing functions complicated the device; that it could not be used as fast as emergencies might indicate. Clint Falk, Philadelphia Electric Co, felt designers had not included all safety devices that might have been incorporated. E. A. Bishop, Commonwealth Edison, and others, found "tedious" every time it is to be connected to ground. In closing, the authors observed that removal of the device for recharging was considered a safety interlock, more important than the inconvenience it occasioned.

Philip Sporn, American Gas & Electric, questioned whether in the breaker design, of the Leeds-Friedrich paper, ingenuity had not been carried too far when so much mechanism is hung in cantilever from a structure subject to misalignment. H. P. St. Clair, also American Gas & Electric, and other discussers, felt that tests of the breaker should have conformed to the symmetrical, rather than totally offset, wave. E. B. Rietz, GE, as well as the authors in closure, felt that lower impulse levels for breakers could be carried too far. It was not fair, they felt, to ask manufacturers to supply the same factor of safety if a breaker is to be used with, say, a 138-kv interrupter design at 161 kv.

PROTECTIVE DEVICES

New Lightning Arrester Standard. H. R. Stewart, *New England Power Service Co* and F. M. Defandorf, *National Bureau of Standards*

Presentation of the new standard "Lightning Arrester Standards for Valve and Explusion Arresters."

Surge Protection of Cable-Connected Equipment. R. L. Witzke and T. J. Bliss, *both Westinghouse Electric Corp*

Analog computer data permit evaluation of influence of magnitude and rate of rise of surge circuits, arrester discharge-voltage characteristics, cable surge impedance and other factors. Tables of permissible cable length included.

The wide interest in surge protection of substation equipment connected through cable to overhead lines was evident from the extensive, favorable comment on the Witzke-Bliss paper at Friday's session. The author's values of minimum permissible cable lengths requiring arresters at both the equipment and the junction between cable and overhead circuits, were confirmed by E. L. Hunter, GE, who reported similar results from a study with slightly different assumptions. Tigg and Vandemaker, Westinghouse, also reported good agreement with findings of earlier studies on 37-ohm cable connected to transformers. M. A. Anderson and W. H. Hatch, Public Service Co of Northern Illinois, urged extension of the investigation to buried cable and aerial cable having "partial metallic coverings". P. L. Bellaschi, urged evaluation of the protection problem at the end of longer cable runs. He asked if surge voltage would double in such cases as it had with shorter runs. In closure the authors felt that attentuation would be a possible factor limiting surge magnification in such cases.

A comprehensive analysis of principles of power system fault limitation and removal was presented in the preliminary report of a working committee of the Fault Limiting Devices Subcommittee of the AIEE Committee on Protective Devices. Planned for subsequent formal presentation, this conference paper recognized the effect of increased generating capacity since the war on short circuit concentration. The report approached the subject discussion by classifying fault control methods and correlating them with types of power systems existing in this country.

POWER GENERATION

Effect of Buck-Boost Voltage Regulator on Steady-State Power Limit. C. Concordia, *General Electric Co*

F. S. Bacon, Jr., Rockbestos, Hamden, Conn; F. O. Schaure, Bethlehem Steel Co, Sparrows Point, Md; F. R. Benedict, Westinghouse

L. N. Grier, Alcoa; T. Montgomery, A-C; R. B. Zane, Okonite; A. D. Coskey, Pub. Serv. of No. Ill.; A. J. Krupy, Commonwealth Ed

Steady-state stability limit of power system is increased almost as much with buck-boost regulator and properly-designed stabilizer as with separately-excited exciter. Stability limit is also increased by stabilizer supplied from alternator terminal voltage.

Regulation of A-c Generators with Suddenly Applied Loads—Part II. E. L. Harder, R. C. Cheek, and J. M. Clayton, *Westinghouse Electric Corp*

Paper presents curves for determination of voltage drop caused by sudden application of large, low-power-factor loads to separately-excited and self-excited alternators. Method based on four main parameters—generator open-circuit time constant; generator transient reactance; exciter response; and applied load. Examples are included.

Bus Transfer Tests on 2,300-v Station Auxiliary System. A. A. Johnson, *Westinghouse Electric Corp*, and H. A. Thompson, *Duquesne Light Co*

Tests determined the optimum transfer time interval for switching auxiliary buses from service transformer to auxiliary generator, and vice versa. Transfers were accomplished by "open transition." Auxiliary generator and auxiliary motors did not exceed safe operating limits and station boilers operated normally during transfer intervals under 150 c.

Results of the Johnson-Thompson paper were confirmed by several discussers, including D. M. Taylor, Public Service of New Jersey, who described similar tests carried out at Burlington, Essex and Sewaren Stations. J. A. Elzi and W. R. Brownlee, Commonwealth Services, stated that an important consideration in "open transition" transfer is the maximum time during which de-energized pulverizers will continue to support boiler fires. Distinguishing between planned and emergency transfers, A. J. Miller and A. Temoshok, GE, pointed out that emergency transfers should be made as fast as possible since residual bus voltage will drop to zero rapidly under these conditions. In closing, Johnson warned that repeated transfers made before optimum time may damage motors.

DOMESTIC AND COMMERCIAL APPLICATIONS

Synthetic Load for Testing Rectifiers. C. L. Tetherow, *Underwriters' Laboratories*

Straight resistance load unsatisfactory for testing metallic rectifiers as used in "fast rate" battery chargers, because its characteristics are very different from battery-charging load. Much closer approximation obtained by capacitance in parallel with resistance.

Flame Detectors for Domestic Fuel Burner Devices. Justin A. Daubel, *Perfex Corp*

Descriptions and diagrams of four classes of detectors, those responsive to temperature, total radiation, luminous radiation, and flame conduction of electricity.

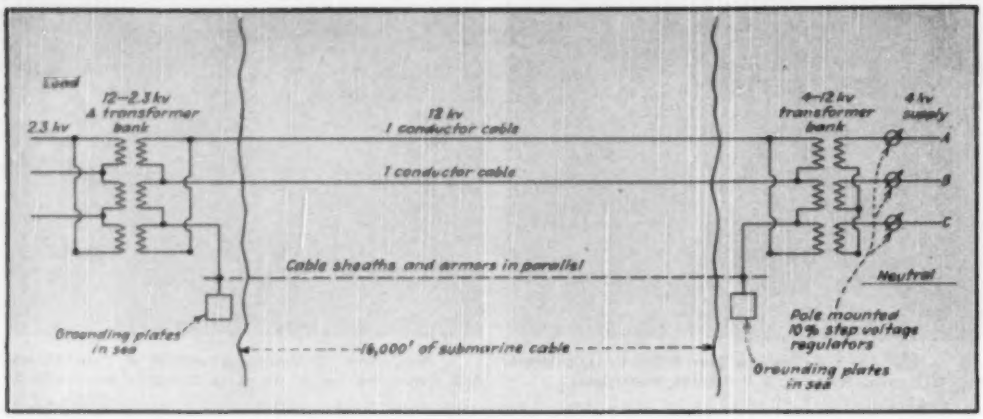
Data presented on heat pumps for residential applications were the basis for a general agreement that atmospheric air and the earth be used in combination as heat sources and sinks. The combination is particularly applicable in colder atmospheres. But ground coils may not be suitable as a sink in summer because the ground might be dried.

F. W. Gay, Public Service E & G Co, Newark, described a method of heating a residence which would not require a continuous source of heat being supplied by the earth; the earth being used merely as a flywheel to coordinate weather variables to the advantage of the heat pump. In this method heat is introduced into the ground by carrying hot fluids first through three central layers of buried pipes and then in parallel through the outer two layers of pipes so that the ground under the house is warmest in the center and colder above and below. When the heat is extracted the fluid passes through the pipes in the reverse order.

LONG TUBE FLUORESCENT LIGHTING

Better performance and extended life can be expected as developments in long-tube fluorescent lamps continue, but probably they won't get any longer—eight feet seems about the limit that can be handled. If the cold-cathode lamp had received more attention in research and promotion, it would be farther along in development than its present 3% of fluorescent sales indicates. The trend is definite toward instant-start lamps, delayed-start is going out of the picture. There is need for basic study of the factors entering into the design of ballasts and circuits for fluorescent lamps. The problems in provision of fixtures for long-tube lamps are not of design to fit lamp characteristics, but are of production of the fixtures of required size. Long-tube lamp costs can be expected to decline because of the smaller proportion of cathode and terminal costs in them than in the shorter tubes. Thus is summed up briefly the four conference papers of T. C. Sargent, Sylvania Electric Products, Inc.; G. C. Harvey, General Electric Co.; H. P. Steele, Benjamin Electric Co.; and B. F. Greene, the Fluorescent Lighting Association.

(*Continued on page* 144)



THREE-PHASE service with two single-conductor submarine cables is British Columbia Electric Co's method of serving Bowen Island, 16,000 ft off the mainland near Vancouver, B. C. Third phase of a 12-kv delta circuit is cable sheaths and non-magnetic armors in parallel. Additional capacity to take care of load growth can be provided by addition of a third cable at a later date

Grounded Cable Sheath and Armor Are Third Conductor of Submarine Circuit

Grounded delta circuit using only two single conductors provides lowest cost per kva, still allows for expansion to serve later load growth

F. O. WOLLASTON
Supt Transmission and Distribution
British Columbia Electric Railway Co, Ltd
Vancouver, B. C.

TWO single-conductor submarine cables, which have one phase of their 12-kv delta supply grounded and connected to the sheaths and armor of both cables, have been installed by British Columbia Electric Railway Co. The installation is planned to accommodate load growth on Bowen Island, near Vancouver, B. C., in stages requiring only reasonable increments of capital investment. Submarine cable was the only feasible method of extending power to the island, separated from the mainland by 3 miles of salt water averaging a depth of 300 ft.

Study of economic and technical features of some 15 proposed schemes resulted in this unique installation which has these features:

1. Carrying capacity approaching that of a three-wire delta circuit is provided by only two single-conductor cables.

2. Installation of an additional cable will provide the equivalent of a spare circuit if increased reliability of the circuit becomes desirable later.

3. If one of the two cables presently installed should fail, the remaining cable could carry all the single-phase load on the island (nearly all the load is single-phase at present).

4. The 16,300 ft of submarine cable was made and laid in one length. This avoided splices in deep water.

5. The cable is armored with non-magnetic aluminum-alloy wires.

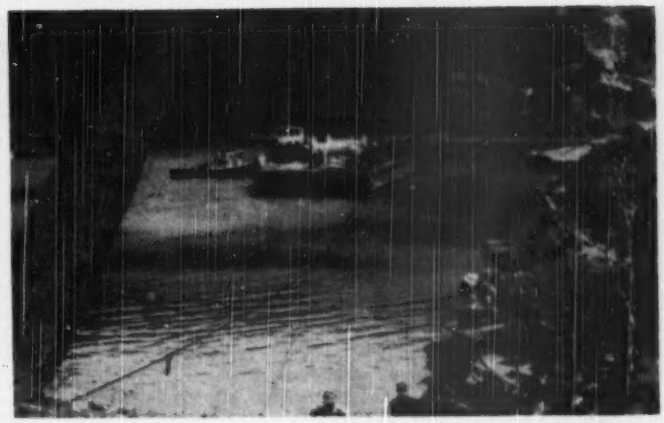
In the preliminary studies, circuit voltages of 4,000, 12,000 and 34,000 v were considered for the cable line. While the initial load to be served was approximately 200 kva, a fairly rapid increase to 1,000 kva or more was anticipated. The 4-kv installation was discarded because the provision for load growth was considered inadequate. Of the several 12-kv and 34-kv schemes studied, the essential data for six proposals are given in the accompanying table to illustrate the principal points which governed the final choice.

The 34-kv installation, Item 1 in the tabulation, was discarded for two reasons. The cable would require several splices in water 300 ft deep, which was deemed risky. The cost of the 34-kv cable would be considerably greater than was justified by the prospective revenue, even after making optimistic allowance for load growth. With the choice thus narrowed down to a 12-kv installation, a decision between three-conductor and single-conductor cable remained to be made. At first, only steel-wire armor was considered suitable for the cable. Items 2 and 3 in the table are typical of the propositions con-

sidered. The single-conductor cable, Item 3, had definite advantages over the three-conductor cable, Item 2. The reliability of a circuit of three single-conductor cables would be far greater than for one three-conductor cable, since three-phase operation of the circuit would be possible even with one cable out of service. Furthermore, the single-conductor cable would be better able to withstand the great pressure of the deep water without distortion. Also, the single-conductor cable would not require submarine splices in deep water. It was decided that an initial installation of two single-conductor cables would have ample carrying capacity and would be the most economical scheme. However, magnetic armoring on the cable would cause an undesirable amount of line losses, as shown in Item 5 of the Table. One of the cable manufacturers then proposed using single-conductor cable with non-magnetic armor. This proposition was found to be feasible and was adopted. The final decision was to install two single-conductor cables with non-magnetic armor. This scheme required the least capital expenditure and gave lowest cost per kva, as shown in the Table, Item 6.

The armor wires are drawn from aluminum alloy 57S, containing chromium and magnesium. The tensile strength of the alloy wires is high enough to give about the same factor of safety as obtained with steel wire armor after taking into account the substantial reduction in weight of the alloy-armored cable. Convincing information was presented as to its resistance to salt water corrosion by a coast patrol boat, HMCS Interceptor. Built 20 years ago with a hull of this alloy, its plates are still in excellent shape. A test plate has been under observation in Halifax Harbor for 15 years, exposed at low tide and under water at high tide. Only minute superficial attack has occurred.

The installation consists of two single-conductor No. 1/0 PILC 12-kv cables, each manufactured in one length of 16,300 ft. The cables are spliced to No. 2/0 laterals at both shore ends. The larger laterals compensate for the reduction in carrying capacity due to burial in the earth instead of submarine lay. The splices



TWO 16,000-ft cables were laid simultaneously from this single barge in about two hours. Duplicate, hand-operated band brakes on the reel flanges provided a spare in case of emergency

Alternative Submarine Cable Proposals

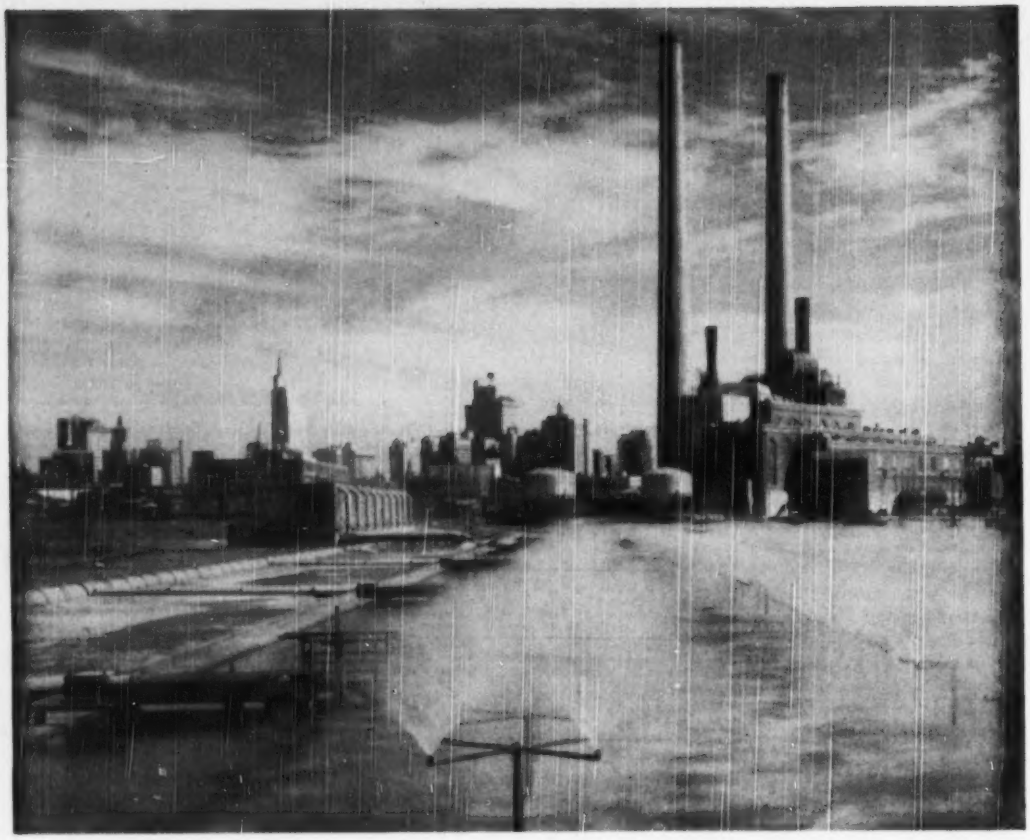
Lowest cost per kva and simple installations favored two single-conductor 12-kv cables with aluminum alloy armor, compared to five other combinations shown

Circuit Voltage of Cable	Cable Size and Type	Type of Armor	Safety Factor of Armor	No. of Splices Required in Submarine Cable	Carrying Capacity of Cable, Kva	Cost of Cable (not installed)	Cost per Kva
34 Kv.	3 c/cf 1/0 Solid	Steel Wire	5.4	8	12,500	$140,000	$11.20
12 Kv.	3 c/cf 3/0	Steel Wire	3.5	2	6,950	73,000	11.20
12 Kv.	3 Cables 1 c/c 1/0	Steel Wire	5.5	None	6,000	63,000	10.50
12 Kv.	3 Cables 1 c/c 1/0	Al Alloy	5.1	None	6,550	63,000	9.60
12 Kv.	2 Cables 1 c/c 1/0	Steel Wire	5.5	None	5,540	42,000	7.60
12 Kv	2 Cables 1 c/c 1/0	Al Alloy	5.1	None	6,500	42,000	6.46

are deeply trenched in at the lowest low-tide mark. The two reels of cable were mounted on a barge for laying as shown in the accompanying photograph. A hand-operated band-brake was installed on each flange of the steel reels. With braking power designed so that one man could control a reel with one of the brakes, the second brake on each reel was a spare. Two tugs controlled the barge and the two cables were laid simultaneously in two hours without incident.

At the present time power is supplied from a 3-ph, 4-w, 4-kv wye circuit. A transformation to three-wire delta, 12-kv, is made at the supply end of the submarine cable. One phase of the 12-kv delta is solidly grounded and connected to the sheaths and armor-wires of both cables. This provides an ample metallic path for the current in the grounded phase of the 12-kv delta. In addition, a parallel path of high conductivity through the salt water is obtained by grounding the cable sheaths and armors through large plates of 57S alloy buried in the shore at low-tide mark. At the receiving end the voltage is stepped down to 2,300-v delta. This was the voltage of the existing system on the island, which was formerly supplied by a diesel plant. Pole-mounted step-type regulators at the supply end control the supply voltage.

With this installation, load growth can be accommodated in stages requiring only reasonable increments of capital investment. The first step would be to change over the distribution system on the island from 2,300 v to 12,000 v multi-grounded wye, our standard rural system. This would require replacing the step-down transformer bank on the island with a one-to-one bank. When the load grows beyond the capability of the 4-kv circuit at the supply end, the supply could be furnished direct at 12-kv delta. The final step would be to install a third cable for direct connection at both ends to 12-kv multi-grounded wye.



A SPRAY POND looks pretty, but how many of your customers know what it is for? Or associate it with a power plant? How many understand that it cools the water that condenses steam or why it's important to condense steam? Tell your customers not only

Tell It All and Tell It Easy

GEORGE KERR
Ebasco Services, Inc, New York

Turning the company inside out so that employees and public can see the works and the working of them will pay out in public understanding and appreciation

TWO LADIES were waiting on the corner for a bus. It was twilight. The lights were just starting to go on in the sixteen story office building of the electric company across the street.

One lady said "Look at all the people they have over there just to write out the bills and count all the money."

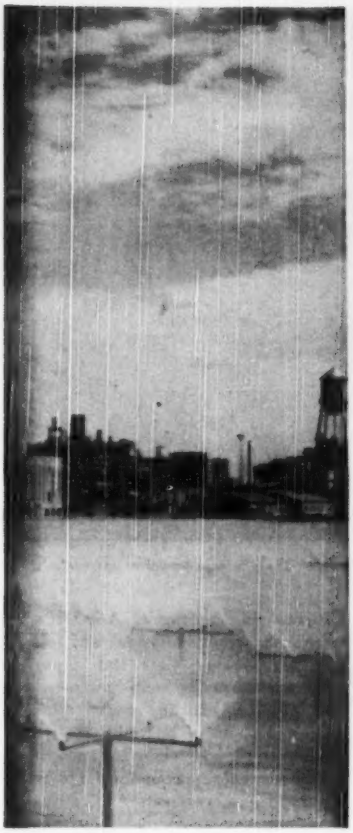
"Yes" commented the other lady, "I hear it runs into the millions. No wonder they need all those people to count it all."

Are those two ladies "dumb" because they talked like that? Of course not! Why shouldn't they harbor such thoughts?

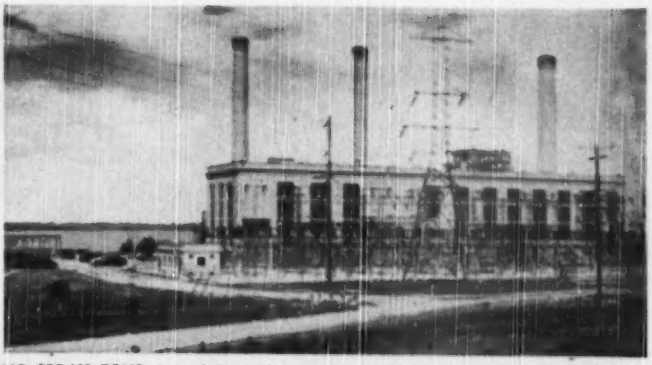
Nobody ever "told them different." Not in words they could understand and thus were willing to listen to. Consequently how are they supposed to know of all the multifarious tasks performed, skills possessed and put to work, by the hundreds of men and women working in that sixteen story building?

How are those two ladies and all the other customers of the company to know "what it takes" to supply the electric service they get so effortlessly?

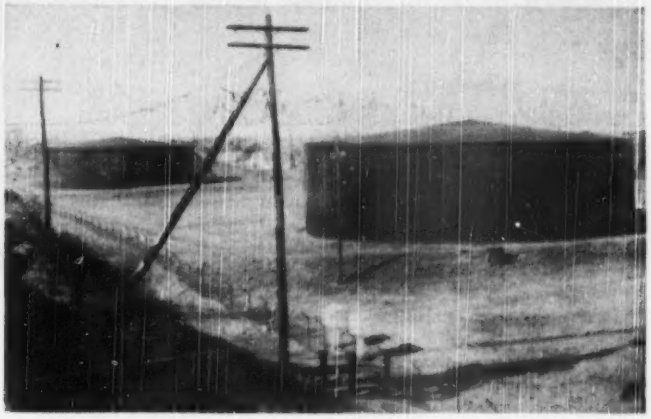
To know, even, how come there is an electric company? How did it get here? As far as most people are concerned it is just about like Topsy—"it jest growed."



about plant equipment and its general functions, but tell them of the money involved



NO SPRAY POND is needed at this power plant, which gets cool water from the lake behind the plant. Do your customers know why condensing water is important?



WHY A TANK FARM is needed, to store emergency power plant fuel, may be news to many but how many customers know that gas to oil change-over can be made in minutes?

Public relations would be improved if people were reminded, in a nice way of course, and in simple words, of a few facts of the economic life of the electric company.

Before Collecting a Nickel

For instance, before the electric company could collect a nickel from the customers:

It had to have a "power plant"—a big building with immense machines in it to make the electricity; (NB not "generate energy") a lot of complicated and intricate (AND expensive) equipment, cables, poles and wires to bring the current to the customers; and cash money to pay the people working in the company.

To pay for all that, where did the "dough" come from?

With most people, for all they know (or care), it was something like manna from heaven.

Nor do they ever entertain the vaguest idea of how *much* money is involved.

Mention a generator. Just *one*. How many customers know the price is 2 to 3 million dollars?

For another example of how little the public knows of the *inside* story of an electric company, take the coal pile.

One utility in the East is the largest user of anthracite coal in the world. But it is not generally known that electric companies use huge quantities of coal, let alone *what* it is used for.

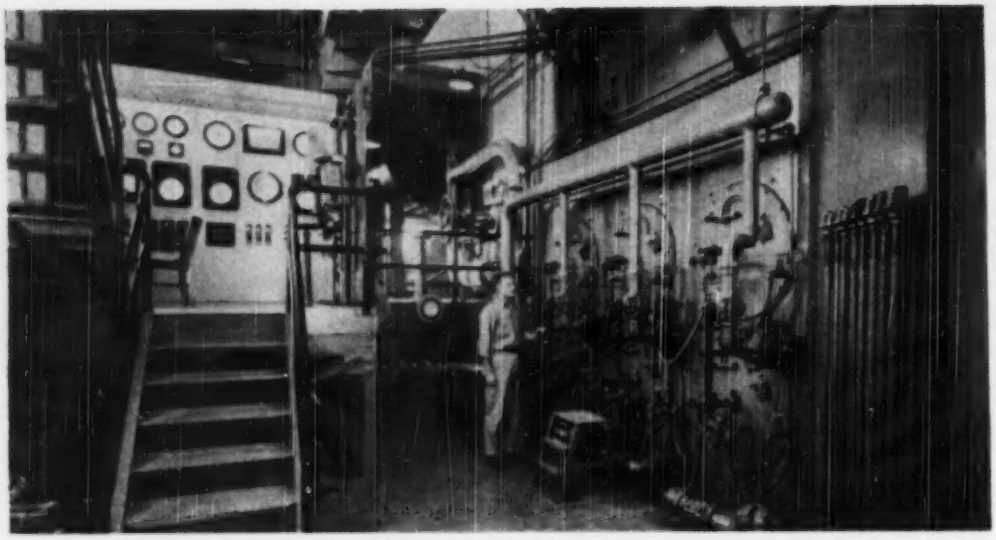
Do electric companies use coal? Here's one answer for you. During a coal strike, railroads were curtailing schedules. A columnist on a New York paper wrote of the Long Island Railroad: "Why are they cutting off trains to save coal? Their trains are run by *electricity!!*"

Explain That Coal Pile

Some will say "Well, it's easy enough for people to know we use coal. Don't they see the coal pile right there by the generating station?"

Sure they see the coal pile by the generating station and the generating station is a great big building and it must take a lot of coal to *heat* a building of that size.

Seldom does an electric company make a plain, simple, statement like: "We burn coal, to heat water, to make steam, to run the machines that make electricity."



DO YOUR CUSTOMERS know that today's power plant firemen don't have to shovel coal—that their job is to regulate valves and controls?

Of such simple, straight-forward statements Chief Justice Holmes once said, "Emphasis on the obvious is often more important than elucidation of the obscure."

It is not intended to claim that no electric companies tell the "behind the scenes" story of their business. Some do. But not many tell the story in words comprehensible by, and thus interesting to, the ladies earlier quoted. An eminently outstanding example of easily assimilable information was recently issued by Dallas Power & Light Co.

This publication, *We Get the Job Done* is twenty pages, 8½ x 11 and is addressed primarily to the men and women of the company because the first job is to inform them. The book tells "of the many phases of our work so that each of us may get a greater appreciation for his own work by realizing it is an important part of the big job all of us do."

It would be a revelation to the two ladies, mentioned at the beginning of this article, to look at this booklet. Every department of the company is literally turned inside out. They're all in there: plant, distribution, engineering, accounting, treasury, commercial, purchasing, rate and economic research and personnel.

Each occupies a double page spread with plenty of photographs and text underneath disclosing "what goes on here" and in many instances, who does it. Thirty-eight photographs are shown—each a separate and distinct activity requiring its own particular knowledge, education, skill, and training.

"Tour" Begins at Power Plant

Starting, appropriately, with where the company's product is produced—the power plants — there are eight good size photographs. One shows the huge spray pond and tells the reason for it. Another shows the "tank" farm where fuel oil is stored against some unforeseen emergency that might cause failure of the supply of natural gas. Which gives emphasis to the not generally known fact, "The switch to fuel oil from natural gas at either plant can be *done in a matter of minutes.*"

A few high spots, picked at random, give an idea of the exceptionally informative, educational and interesting manner each section is dealt with.

Who would expect to find in an electric company, a blacksmith shop and a carpenter shop!

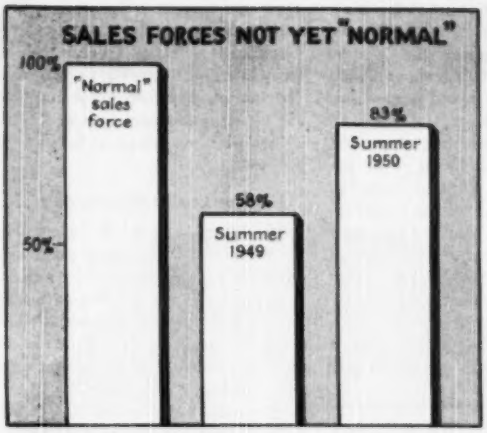
There's a picture of both and about the latter is printed "Most anything that is made of wood can—and frequently is—made here."

This is one of nine descriptions of different kinds of work done in the distribution department. Another is about the "trouble division" and tells why "Troublemen are 'top flight' men, who have the know-how necessary for such exacting work." And there's a photo of one with his red trouble truck. Of course his name is given. Also there's a good photo of an overhead line crew setting a 250-kva transformer on an overhead platform. The editor made sure to print the weight of the transformer—3 tons.

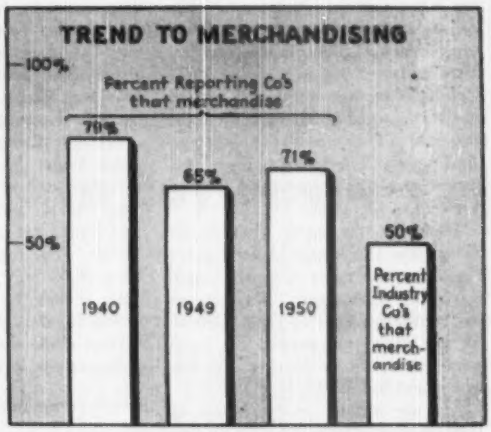
There's a view of the large, well-lit, laboratory where tests are made to see that strict standards are maintained in metering equipment and that meters measure electricity accurately. Another photograph brings out that so much work is done in the distribution department that it has to have its own accounting department to facilitate its operation.

An especially outstanding feature of the publication and one which contributes greatly to its effectiveness, is the expert photography. The photographs are replete with men and women and the pictures are "action" shots. Everybody is doing something —not just standing there looking at the camera. The job is further "humanized" by printing the names of the people in the pictures.

Benefits of such a publication are manifold to both the employee and the customer.



NUMBER OF SALESMEN reported by 34 companies as average normally needed for satisfactory load building have not been hired



RETURN TO MERCHANDISING by reporting companies is shown by first three bars; fourth bar shows 50% of companies merchandise

Residential Load Building—The Picture Today

Appreciation of need for increased sales effort is spreading, but manpower and organization have not yet caught up with population and income growth

ROBERT E. GINNA
Vice-President
Rochester Gas & Electric Corp
Rochester, N. Y.

LAST SUMMER the electric utilities had about 58% of what they consider should be their "normal" in sales personnel; next year they expect the proportion will have been increased to about 83%. This is in the face of the fact that the sellers' market in major appliances declined rapidly in 1949, as is indicated by drops from 1948 of 400,000 and of 300,000 in sales of ranges and water heaters respectively.

The above ratios of sales personnel come from a survey of 34 major utilities serving 35% of the domestic and farm customers in the country and with revenue from those customers of $600 million for the 12 months ending June 30, 1949. The smallest of the 34 companies has around 35,000 customers and the largest more than a million. The average "normal" sales force reported was 139; the average for July 1, 80; the average planned for 1950, 115. The "normal" sales force is that considered to be adequate by the companies reporting. Of the 34 companies, 14 are straight electric utilities and 20 are combination gas and electric.

The ratios appear the more significant because the companies included in the survey represent, perhaps, a higher degree of sales-mindedness than characterizes the industry as a whole. Of the 34 companies, 65% now actively merchandise either major appliances only or both major and minor. This merchandising ratio is higher than that for the whole industry which is probably around 50%. In 1940, 79% of them did merchandise actively and in 1950 71% intend to do so. If others not now merchandising, but apparently considering it, decide for it, probably the ratio will return to the 1940 level, about 80% of the 34 companies.

The trend back to merchandising is especially interesting because, 9 companies reported organized effort among dealers to promote legislation banning sale of appliances by utilities. Apparently such movements are being counteracted by concessions to dealers and improved co-operation with them.

Reasons for merchandising were stated in replies as:

1. To enlarge customer acceptance of major appliances.
2. To stimulate dealer selling.
3. To build load adequately.

In my opinion, a fourth reason should be added. It is, to reduce new business expense and to improve earnings for the common stock holder.

Why should these utilities feel as they do about merchandising? Aren't there more dealers now than before

the war? Certainly there are. The companies covered in the survey averaged about 550 dealers each in 1940 and over 900 as of June, 1949. But the average mortality among dealers reported in the survey for the first half of 1949 was 60 per company. And more will drop out as fewer customers come in to buy and the need for selling increases.

Replies in the survey seem to indicate that the companies are more "sold" on the value of home economists than of salesmen. The average of "normal" forces of economists is 20 per utility; at present the companies have an average of 19 each and expect to have 22 in 1950.

Average annual compensation of merchandise salesmen reported was $3,350. About 25% of the reporting companies are planning to increase salesmen's income; the others seem to think the present figure about right.

The survey uncovered little that is new or unusual in selling techniques or methods. I feel this is quite disturbing and a bit hard to understand when most sales experts are urging all kinds of promotional stunts and gimmicks. Also, it is obvious that all we sales executives must re-learn salesmanship. While doing so, we will stimulate our younger sales personnel towards creative selling, which is not new but which unfortunately most of us seem to have forgotten.

Some Bright Spots

There were, however, some bright spots. A few companies were originating new sales ideas and reviving old ones. There is the Lever Brothers-Westinghouse stunt of tying-in sales of soap and appliances. Here and there dealers are trying the painless technique of customers paying for appliances by dropping coins in a box to keep the particular appliance in operation. But only 3 of the 34 companies said they were going to participate in the Lever Brothers-Westinghouse campaign. At this point let me remark that the American Gas Association is attempting a national "Old Stove Round-up" in a co-operative effort of manufacturers, distributors, dealers and gas utilities.

Speaking of gas, it is significant to note that 23 of the 34 companies reported no new or unusual sales efforts to combat competition of bottled gas in rural areas. Only one third said they were doing anything of this kind. On the other hand, 24 of the 34 said they were supporting the electric kitchen promotion program and were providing kitchen layout suggestions for their customers.

On subsidizing electric range and water heater installations, 9 of the straight electric utilities reported "yes" and 5 "no". Of the combination companies, 2 replied "yes" and 18 "no." For ranges the subsidy ran from $4 to $65, average $27. For water heaters the range was from $5 to $80.50, and the average $31.

Most of the companies have dealer organizations in their territories and are members of them, but only one fourth attach much promotional value to these associations.

TODAY'S PRESSING PROBLEMS IN LOAD BUILDING

1. Bottled gas competition
2. High wiring and plumbing costs
3. Dealer co-operation
4. Training dealer salesmen
5. Radiant heating

About two-thirds of the reporting companies make market surveys but only one-third use them for compiling prospects. This is in sharp contrast to other retail industries' practice.

No companies are renting appliances, although half of them have at one time or another given consideration to doing so.

The companies are averaging about $165,000 annually for domestic sales advertising or about 46¢ per year per customer. It is encouraging to report that they plan to increase their advertising about 10% in 1950.

This report would not be complete if I were not to touch upon the appliances themselves. It seems that only one-fourth of the companies feel that present electric appliances are better than pre-war models and about half feel the quality is just fair. That minimum performance standards for manufacturers would improve quality and reduce servicing problems as well as help to improve customer acceptance of major appliances is the opinion of 40%. In this connection, it was interesting to learn that 15 of the 34 companies surveyed have appliance testing laboratories of their own and generally sell only major appliances approved therein. Ranges, washers and dishwashers were particularly mentioned as being troublesome in servicing, and it was the opinion that distributors should cooperate more on the servicing problem. Cost and availability of parts seems to be quite a problem.

Items of Least Public Acceptance

The major electrical appliances which have had the poorest public acceptance were mentioned by the 34 companies in the following order; Driers, dishwashers, disposals, ironers, and water heaters, and the reason most given was lack of promotional effort and poor demonstration. In contrast, the water heater stands out as the appliance most successfully promoted.

Now coming to the question of terms to both utility and customer:

Most of the merchandising companies feel that the manufacturers have cut their discounts too much and something should be done about it. Some mentioned that they do not sell certain appliances because of poor discounts and margins of profit. In general, appliances are being sold at established list prices but recently price cuts have been resorted to by one-third of the companies in order to stimulate sales. As for credit terms to customers, the dealers and utilities offer about the same terms and most of the companies are opposed to credit terms being further liberalized.

Lower than normal inventories of appliances were reported by 40% of the merchandising companies, about 20% reported higher than normal. Some 40% of the companies reported their present sales volume of appliances good; about the same number said fair, and the others, poor.

And now for some saturation figures on where we stand today in major appliances connected to our lines as indicated by the survey group:

Appliance	Range in Saturation between Companies	Average Saturation
Refrigerators	64 to 90%	78%
Freezers	1 to 10%	3%
Ranges	2 to 32%	16%
Water Heaters	1 to 23%	6%

After seeing these figures, does anyone question that we in the electric business still have a huge market? The data show there is wide variation in the potential markets between

(*Continued on page* 155)

WE LINED UP THE FLUX PATH

TO CUT DOWN SIZE!

Twelve years ago, General Electric introduced the Spirakore transformer. It was revolutionary! It was the first distribution transformer in which the flux through the core followed grain direction of the steel. Literally, the crystals of cold-rolled steel were lined up to provide the best possible flux path and then, by spirally winding the core, we lined up the steel so the flux would follow this path. Magnetic properties of the steel were so improved that we were able to build a much smaller, lighter transformer—that sold at a much lower price.

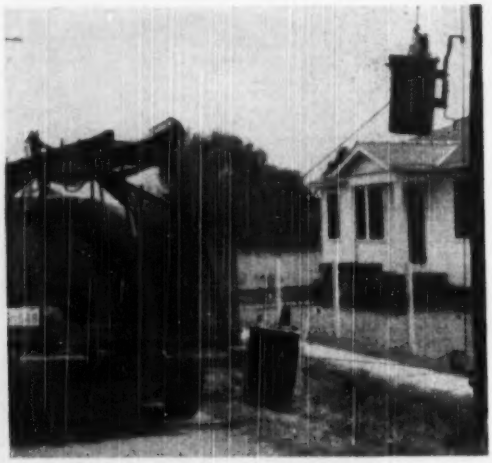
Now many *small* distribution transformers are built along these lines. But General Electric has not stopped here. By adapting this same principle to larger cores, we have brought weight savings to the entire line of single-phase, outdoor distribution transformers—up through 500 kva. Nor did we stop with the core. We improved the impulse strength of the coils—improved the clamping construction for greater mechanical strength. We sealed the tanks to prolong oil life—and even developed a new, better synthetic resin paint that is baked on, and which reduces maintenance costs.

Today—as twelve years ago when lighter, smaller Spirakore transformers made history—Spirakore still leads the field—the finest distribution transformer we have ever made, the finest you can buy. Ask for bulletins GEA-4885 and GEA-4521. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

COMBINATION light duty service and construction truck enables local forces to haul and set poles up to 40 ft long. Jack-knife derrick arrangement provides rapid positioning of pole derrick for pole setting or for hauling it above cab. Note light weight pole dolly



REPLACING a distribution transformer by use of under-floor winch on combination truck. Line is carried through to horizontal sheave wheels to permit pulling at 90 deg from truck position. If truck is mired, winch line is clear to pull at 180 deg to the truck position

Combination Service-line Truck Has Many Uses

H. L. DELONEY
Assistant Chief Engineer
Louisiana Power & Light Co

LOUISIANA Power & Light Company is now operating 24 dual purpose combination service and light construction trucks in their operating districts which are not equipped with heavy duty construction trucks, and plans to add more. These trucks enable local forces to construct short extensions and set up to 40-ft poles without having to call in outside construction crews. When not in use on construction work, the trucks are used in normal service work—running services, installing meters, line maintenance, etc—where operating costs of the unit are comparable with costs on conventional ½-ton and ¾-ton trucks normally used for that type of work.

The bodies were constructed, by McCabe-Powers Body Co, to specifications of Louisiana Power & Light Co. They are built around their standard Series 35M utility service body with various additions required for adaption to light construction work. Trucks used are standard ¾ ton heavy duty models, equipped with mud grip tires.

The "Jack-knife" derrick arrangement provides almost instantaneous positioning of pole derrick for pole setting or for hauling position above the cab.

Stiff-leg Eliminated

The cable bridle arrangement from the front edges of the truck body to derrick head eliminates conventional stiff-leg, conserving room in truck body proper and resulting in lighter weight.

Positioning of derrick footing at top of tool compartment near rear end of truck results in lighter derrick weight and permits carrying derrick over cab.

Location of winch underneath truck body floor, with winch cover in place, and winch line carried out beneath floor bed, conserves truck hauling space and makes it unnecessary to remove or shift truck loads when the winch is operated.

Sheave Wheels Add to Versatility

Sheave wheels constructed in rear bumper allow use of the winch cable throughout an operating range of almost 360 deg without repositioning truck.

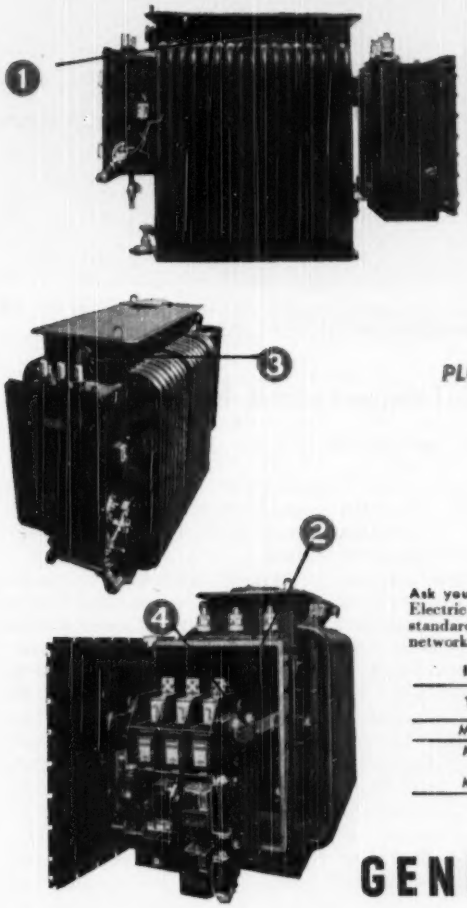
This arrangement facilitates the use of the winch in performing many duties manually with the aid of rope blocks, etc. Lowering and raising of large distribution transformers becomes an easy routine job. When the truck is mired in bad roads the winch line arrangement allows pulling

The a-c secondary network system is now recognized as *the* lowest-cost system for providing high-quality service to heavy load areas. While normally used for business sections of cities—50,000 or more in population—it will frequently pay its way in smaller towns as well.

But—to realize the full savings possible with networks, you must use standardized network equipment. For example:

YOU SAVE ON MAINTENANCE when you specify

Standardized Network Equipment



1 MAJOR GASKETS ARE ELIMINATED by welding, not bolting, transformer cover and switchbox to the main unit. Locating the tap changer behind a pipe plug eliminates a packing gland around an external shaft.

2 BUSHINGS can be removed externally, without opening the main transformer tank.

3 ALL TRANSFORMER ACCESSORIES—liquid-level gages, thermometer, tap changer, and all valves—are located at the high-voltage end of the transformer, easy to get to and check.

4 NETWORK PROTECTOR can be slid out on rails for quick inspection. Relays plug in—can be easily removed and replaced for checking.

PLUS FASTER DELIVERY— G-E standardized network transformers and protectors can be supplied on shorter delivery.

LOWER PRICE— G-E standardized network units are appreciably lower in price than non-standard designs.

LOWER INSTALLATION COSTS—G-E standardized network units are designed for narrower, shallower vaults, saving substantially in vault-construction costs.

Ask your G-E representative or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y. for full information on standardized network equipment. Bulletin GEA-5024 describes network transformers; GEA-2017, network protectors.

INCREASED Interrupting Ratings on Network Protectors

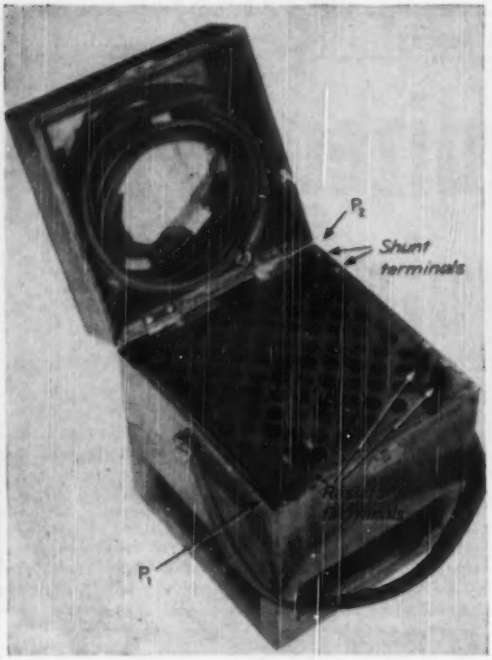
Type	Continuous Rating in Amperes	Interrupting Rating in Max. R.M.S. Amperes
MG-13	200 to 600	20,000
MG-8 or MG-9	800, 1200, 1600 2000 2500 and 3000	30,000 35,000 60,000

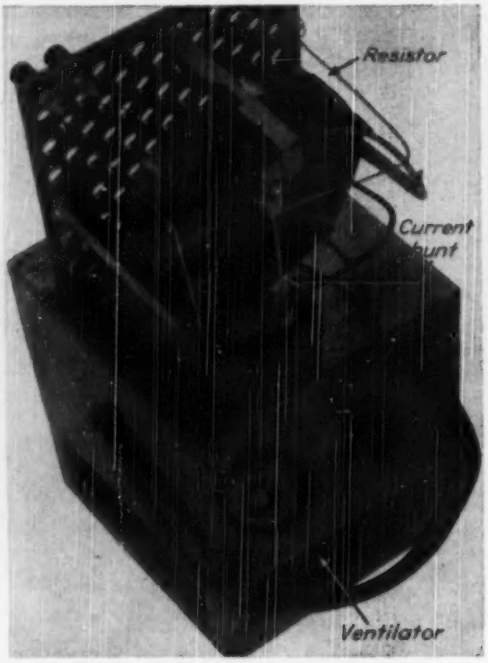
GENERAL ELECTRIC

either forward or backward.

The conventional heavy duty extension ladder is standard equipment. It can be used in place on the truck at an inclined position over the rear end or in an inclined position over the truck cab, and is very handy in the operating districts which are not provided with ladder trucks. Tree trimming, street light replacements and maintenance are materially simplified through its use.

• • •





CHECKING DEVICE for temperature recorder is mounted in case ready for use. Terminals P_1 and P_2 connect to station battery. At the right, combination of tapped spiral-wound pancake resistance coil and reference current shunt are exhibited on top of the case

Resistor-Shunt Checks Field-Temperature Recorder

I—Development of Test Device

M. A. STECKEL
System Meter Superintendent
Appalachian Electric Power Co
Charleston, W. Va.

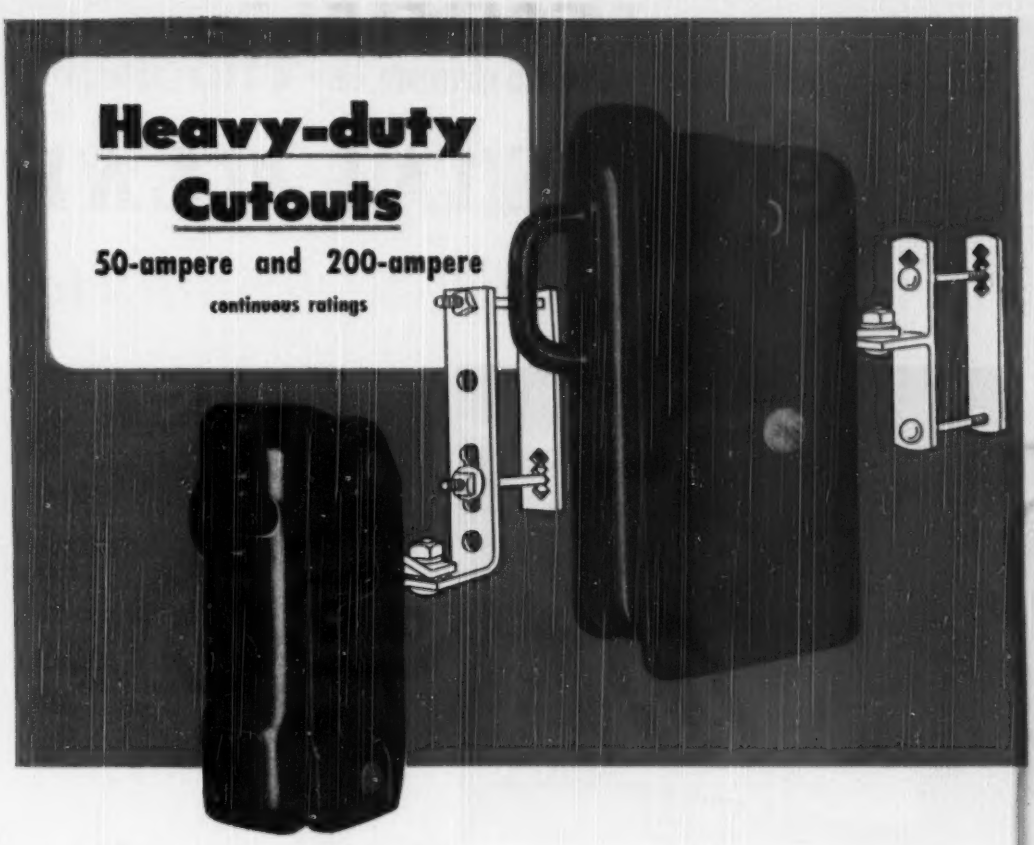
A RELATIVELY simple and inexpensive testing device—a combination of a tapped resistor and a current shunt—is being used to check field temperature recorder indications quickly on synchronous condensers and generators. The two desired readings are those of a field winding (as in a hydrogen-cooled synchronous condenser) at an operating temperature of 70 C or a maximum permissible temperature of 120 C. (For generators the maximum permissible temperature limit is 125 C.)

In addition, this test unit enables the station personnel to determine whether the recorders or other parts of the installation require attention. The combination unit was developed by members of the Appalachian Electric Power System Meter Dept.

The test unit is designed to check Leeds and Northrup recorders. The type of recorder used is essentially a Double Kelvin Bridge. In that instrument the potential drop across the dc field winding (which varies with temperature of the winding and also the field exciting current) is balanced against the potential drop across a constant resistance in the field circuit. In the application being considered, this resistance is a 100-mv dc shunt of appropriate current rating.

Basically, the test device consists of a reference current shunt in series with a tapped spiral-wound pancake resistance coil mounted in an adequately ventilated case. Resistances of the tapped coil and its current shunt are proportioned so they have the same ratios as the resistances of the field winding and field-current shunt when the field is operating at 70 C and 120 C respectively.

The unit merely requires (1) joining the testing circuit to the recorder terminals which are normally con-



. . . both having 8000-RMS-ampere interrupting capacity

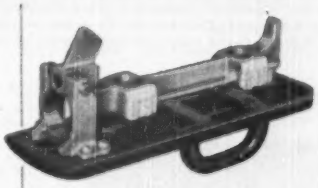
Here are two heavy-duty enclosed indicating fuse cutouts for high power capacity distribution feeders. They have interrupting ratings of 5000-rms amperes at 5000 volts (or line-to-neutral of 8330-volt grounded wye systems) and 8000-rms amperes at 2500 volts (or line-to-neutral of 4160- or 4330-volt grounded wye systems).

Cutout shown on the left is the new heavy-duty 50-ampere unit —for all who want *high interrupting capacity* without paying for unneeded high continuous current rating.

Cutout shown on the right is the standard heavy-duty 200-ampere indicating unit incorporating recent improvements in door and swivel hanger support.

Both units have housings of wet-process porcelain, glazed inside and out, with hanger support cemented into back—doors of molded Textolite, compound—and fuseholder tubes of laminated linen-base Textolite and fiber, easily replaced and with exceptional resistance to both weathering and arcs—and both have spring-operated indicator arm to pull cable downward and completely out of tube —assuring quick interruption even at low currents.

For details and prices ask for Bulletins GEA-3688 and -5019. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

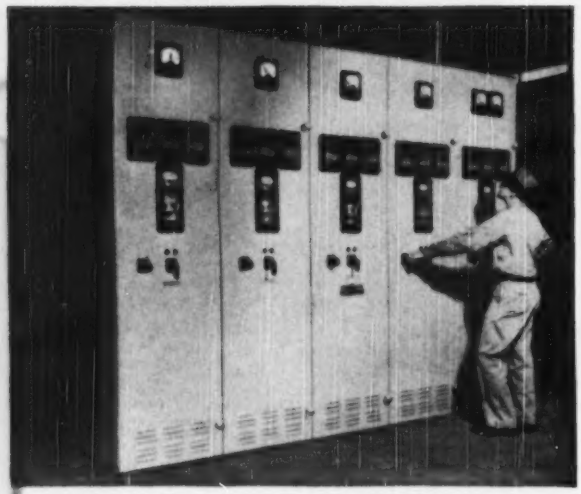


400-AMPERE DISCONNECTING BLADE FOR 200-AMPERE CUTOUT

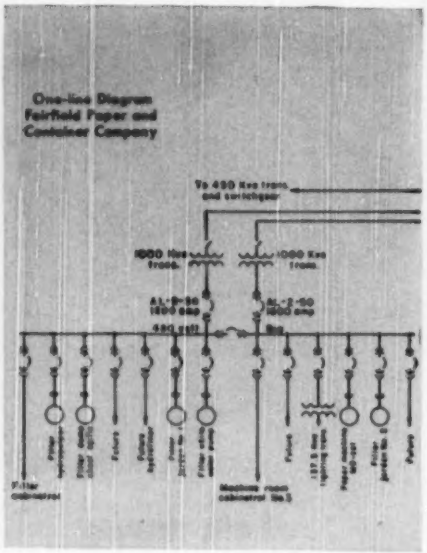
Simply by changing the door, the 200-ampere fuse cutout can be converted to a 400-ampere disconnecting cutout. This unique disconnect door can be closed, with the hinged blade in open and completely isolated position to give positive indication that the circuit is open.

GENERAL ELECTRIC

FAIRFIELD
PAPER AND CONTAINER CO. chooses a
METAL-CLAD
for



General Electric 5-kv Type MI-6 metal-clad switchgear consisting of one incoming-line breaker and four feeder breakers to handle 4160 volts at Fairfield Paper and Container Co. Magne-blast air circuit breakers are rated 1200 amperes, 100,000 kva interrupting rating. Note neat appearance of metal-clad unit. It's space saving too, and the metal-clad construction offers operating safety to personnel. Units like this are easily installed and can be added to with a minimum of bother and expense. Instruments and relays are co-ordinated for positive protection of circuits.



G-E Cabinetrol units provide centralized control for the liner stock system. Unit controls motors, valves, agitators, etc. Ammeters record load carried by hydrapulper and hydrafiner. Four other Cabinetrol units are used throughout the mill.

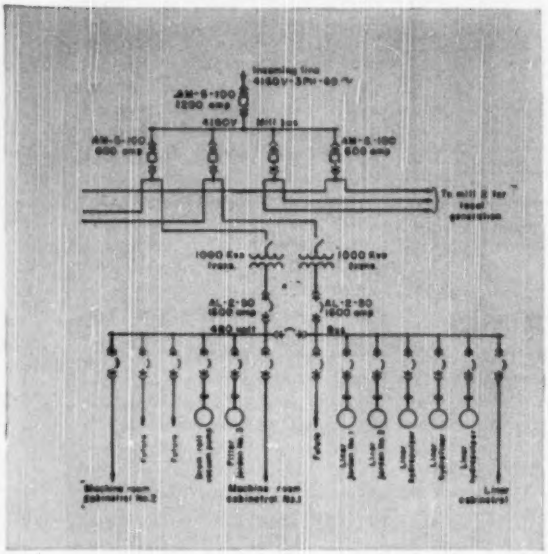
The Fairfield installation is a complete General Electric project—one source of responsibility plus the very best in co-ordinated planning, engineering, manufacturing, and servicing facilities to give maximum savings and efficiency to the customer.

Two G-E low-voltage metal-enclosed switchgear equipments take the 480-volt power from the 1000-kva transformers and distribute it to motors, lighting transformers, and five Cabinetrol units. The Type AL-2 transformer secondary breakers and tie breakers are rated 1600 amperes, 50,000 amperes interrupting rating. Type AK-1 drawout air circuit breakers of 25,000 ampere interrupting rating are used to feed motors and Cabinetrol. Breakers for future circuits can be installed in spare compartments. G-E air circuit breakers have adequate "IC" (Interrupting Capacity) for short circuit protection, are easily removed for inspection.

secondary-selective system using

SWITCHGEAR

continuity of service



At the new Fairfield Paper and Container Co. installation General Electric metal-clad switchgear receives the incoming 4160-volt power and distributes it to 4-1000 kva transformers for step-down to 480 volts. G-E metal-enclosed switchgear handles the 480-volt power through air circuit breakers of the drawout type. In general, all motors rated 60 hp and above are served by an individual breaker. Five Cabinetrol units are fed by air circuit breakers. Note that costly secondary feeders are short.

This secondary-selective system is only slightly higher in cost than a simple radial system, and provides Fairfield insurance against a complete shutdown in case of failure of any one transformer or its primary feeder cable. If trouble occurs the normally-open tie breaker is closed, thus providing an alternate source of power which permits the mill to operate at slightly reduced capacity.

Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

here's why...

"When we planned our new facilities it was decided that a secondary-selective power distribution system would assure us of the continuous power, even in case of a major fault, needed for continuous-process operations like ours. We ordered G-E switchgear because their "metal-clad" protection safeguarded our employees, and because we could get all engineering, equipment and service from one organization. By dealing with one company we saved considerable time and money. The units arrived complete and we installed them in very little time."

H. L. CUSTER, VICE PRESIDENT AND GENERAL MANAGER, THE FAIRFIELD PAPER AND CONTAINER CO., BALTIMORE, OHIO

MODERN INDUSTRIAL **power distribution systems using G-E switchgear are applicable to any industrial plant or commercial building where you want proper voltage for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs. A complete system, using G-E switchgear, costs you less than a "piece-meal," makeshift affair.**

INVESTIGATE TODAY **the many advantages of using General Electric switchgear in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—or write for the helpful bulletins listed below.** ***Apparatus Department, General Electric Co., Schenectady 5, New York.***

GEA-3083	Metal-clad Switchgear
GEA-4966	Low-voltage Metal-enclosed Switchgear
GEA-3592	Load-center Unit Substations
GEA-3758	Load-center Power Distribution
GEA-4057	Interlocked-armor Cable for Primary Circuits
GEA-4352	Flamenol Cable for Secondary Circuits

GENERAL ELECTRIC

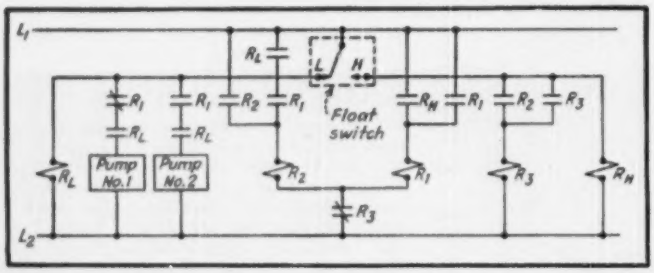
nected to the field terminals and field-current shunt, and (2) connection of the end terminals to a dc source (such as the station battery).

To avoid excessive drain on the station battery during a test, the unit is designed to draw approximately 1.5 amp at 130 v. It is not necessary to consider the length of leads or actual value of the supply voltage (within practical limits), since it is only the ratio of the coil resistance to the shunt resistance which determines the recorder reading.

In installations a 4-pole, double-throw switch is provided as a convenient means of changing the recorder from the operating to the testing circuit. This arrangement allows the station personnel to check performance periodically, thus saving manhours and transportation expenditures for unnecessary inspection of temperature recorders.

Construction and connections of the checking device will be outlined in an ensuing issue.

• • •



SCHEMATIC ARRANGEMENT of relays used in place of mechanical alternator to insure equal usage of equipment in 2-pump unit. Using relays for this purpose reduces initial cost

Standard Relays Replace Mechanical Alternator

FRANK E. REEVES
Senior Electrical Engineer
Bernard & Burk, Baton Rouge, La.

A CONVENIENT SCHEME has been developed for using standard relays in place of a mechanical alternator to provide for equal usage and wear in installations where two equally-sized pumps or compressors are required to obtain reliability of operation. In a sense this is an outgrowth of wartime progress in the design and production of small and highly reliable relays. Considerable saving in initial cost may be expected by this method.

The controlling float switch must be double-throw and preferably of the snap-acting type. As with the mechanical alternator, transfer of control from one pump to the other occurs after shutdown of either pump. In the example, we have a water storage tank with a standard float switch the contacts of which close when the water is low and open when water is at the higher level when the pump should be shut down.

In the elementary diagram feed lines L_1 and L_2 are shown de-energized. When the feed is energized, Pump 1 will start immediately. Feed is through normally closed contacts of relay R_1 and normally open contacts of relay R_L whose coil energized when float switch L (for Low) contact is closed. When the float switch is satisfied and L contact opens, Pump 1 shuts down. When contact H (for High) of the float switch closes, relay R_H is energized, causing coil of relay R_1 to be energized through normally open contact of R_H. Relay R_1 seals in through its own normally open contact, so that when contact H of the float switch opens, R_1 remains energized even though R_H becomes de-energized.

When contact L of the float switch closes again, Pump 2 will start through normally open contacts R_1 and R_L. In addition, relay R_2 will be energized and will remain so because of a sealing-in circuit, after the float switch is again satisfied and its L contact opens. When its H contact again closes, relay R_3 becomes energized and seals in through its own contact. Sealing circuits of both R_2 and R_1 are broken at this point, with the circuit restored to its normal and original condition when contact H of the float switch breaks. Pump 1 starts again when L contact of float switch closes.

Standard "Manual-Off-Automatic" selector switches have been omitted for simplicity, but should, of course, be added in the ultimate installation. In sump pump applications, connections to H and L on the float switch would be reversed. A high-level float switch, which will start the two pumps in case one pump is inadequate or fails to start, may readily be added to the circuit illustrated.

Book publication rights reserved by author.

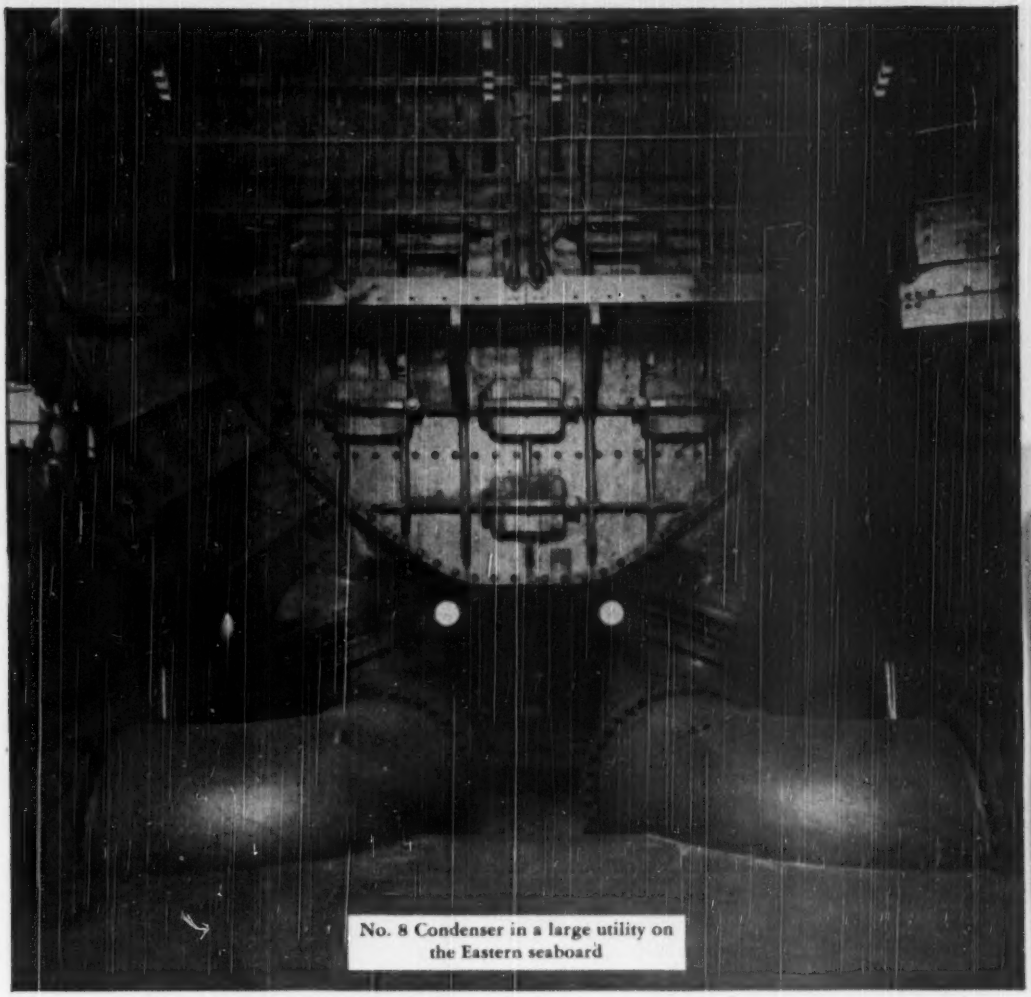
• • •

Manhole Cleaning Time Reduced 75%

EVERY YEAR some 10,000 tons of muck and dirt are removed from 190,000 manholes and service boxes in the territory of the Consolidated Edison Co of New York, Inc. These installations house the transformers and cable splices in the company's underground distribution system.

Manholes were formerly cleaned manually by a slow scooping-out operation that did not always produce the results desired. The company engineers devised a method that cut the cleaning time approximately 75% and requires a crew of only two men.

In the new cleaning method a tank truck supplies water which is hosed at high pressure into the manhole. Dirt turns quickly to a sludge which is pumped out and passed through screens and filters in the tank truck. The original water is salvaged for further dousings.



No. 8 Condenser in a large utility on the Eastern seaboard

don't let FOULING get your figures ALL FOULED UP!

● One important factor taken into account when figuring on the heat-transfer capacity of a condenser is fouling. But the effect of the tube alloy on both rate and amount of fouling is sometimes ignored in design calculations. The acceptance test of a condenser is made with clean tubes. However, the average heat transfer rate varies with time, and fouling is the chief factor in such variation. In many applications this indicates the need for serious consideration of cupro-nickel tubes, which are recognized to have superior anti-fouling characteristics, as well as high resistance to corrosion, erosion, impingement. Thus it can be said that cupro-nickel, 30%, will provide more uniform transfer rates over a period of time, require cleaning much less often, and last longer . . . Revere makes condenser tubes in cupro-nickel as well as in all the other customary copper alloys. We will gladly collaborate with you in a study of the economics of condenser tube selection to meet your needs for true economy. Write for reprint of article entitled "What Factors Should You Consider in Selecting Condenser-Tube Alloys?"

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, NewYork 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N.Y.— Sales Offices in Principal Cities, Distributors Everywhere.

"We stopped motor burn-outs and saved time and money for a large company..."

by Installing..

"Recently, while rewiring part of a large manufacturing plant here in Salem, we installed Fusetron dual-element fuses in motor-running protection size to back up the overload protection already installed on the motors.

"On several occasions, for some reason, these protectors failed to operate when they should have and the motor would have burned out except for the opening of the Fusetron fuses.

"The company's plant engineer was so impressed by the way these Fusetron fuses prevented damage to the motors and saved the company time and money that he authorized us to install Fusetron fuses throughout the entire plant."

Howard Firestone, Owner
FIRESTONE ELECTRIC COMPANY,
Salem, Ohio

Facts About FUSETRON Dual-Element Fuses

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 amperes both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Fusetron DUAL ELEMENT Fuses

with their

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Stop Wasting Time and Money—

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name_____

Title_____

Company_____

Address_____

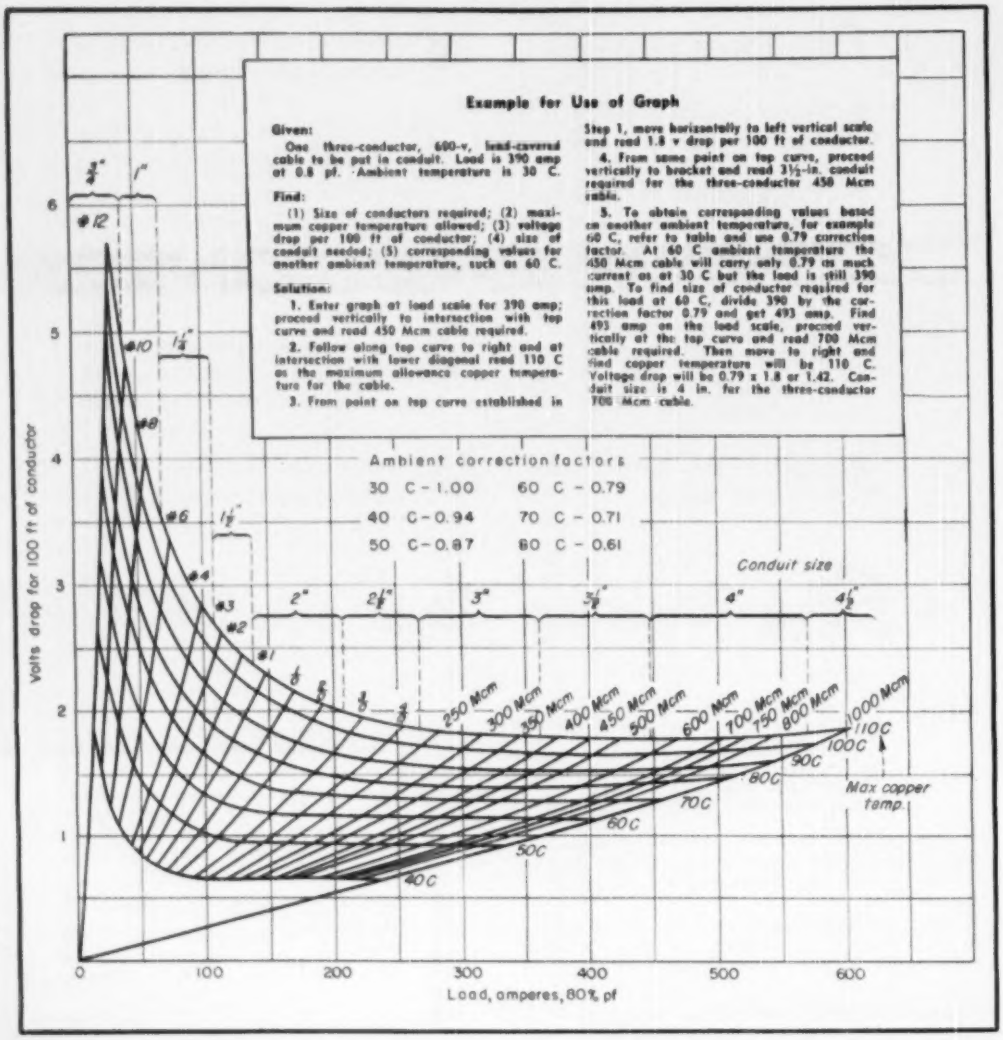
City & Zone_____ State_____ 250

Determine Voltage Drop and Conduit Size For One 3-Conductor, 600-v, LC Cable

H. S. MOORE, Chief Engineer, Rockbestos Products Corp, New Haven, Conn.

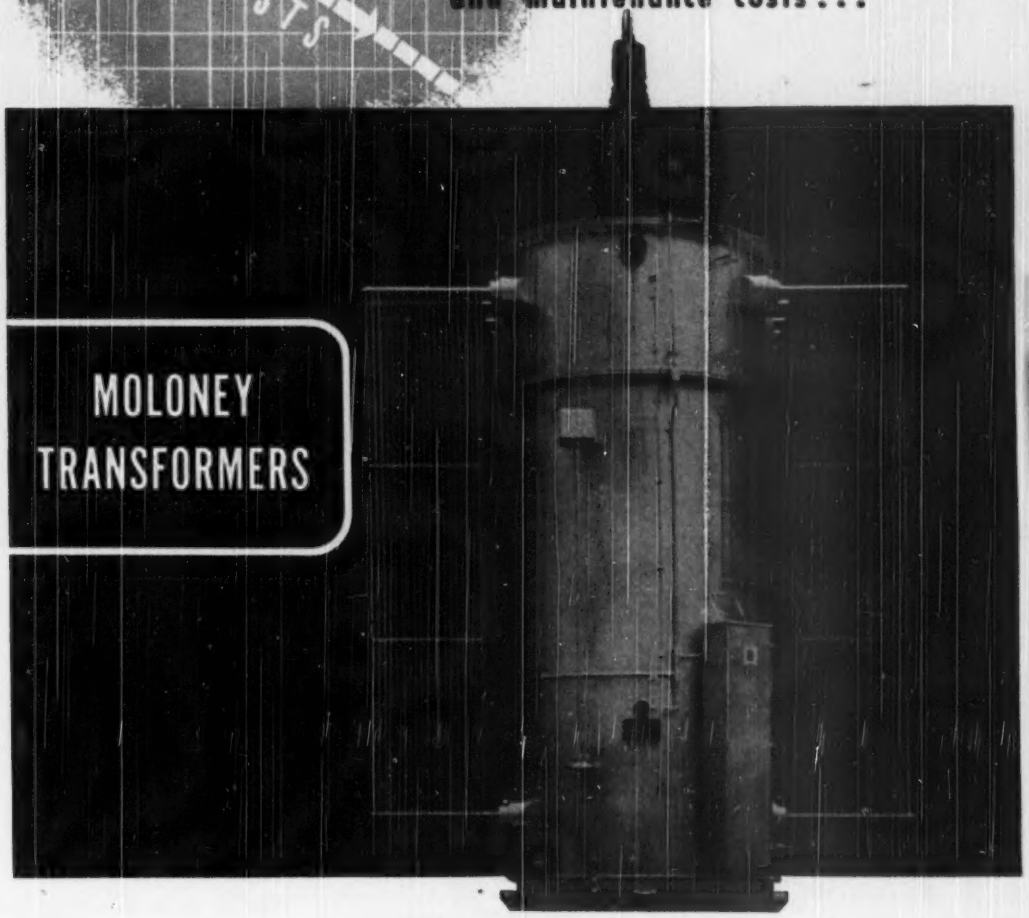
Graph gives voltage drop and copper temperature for cables carrying rated and less than rated current, also size of conduit, based on 30 C ambient temperature. Top curve shows the rated current (at maximum copper temperature) for sizes shown, when a lead-covered three-conductor cable is installed

Graph is quite accurate when calculating for Rockbestos AVC cable and can be used with fair accuracy for other types of insulation.


Example for Use of Graph
Given:
One three-conductor, 600-v, lead-covered cable to be put in conduit. Load is 390 amp at 0.8 pf. Ambient temperature is 30 C.
Find:
(1) Size of conductors required; (2) maximum copper temperature allowed; (3) voltage drop per 100 ft of conductor; (4) size of conduit needed; (5) corresponding values for another ambient temperature, such as 60 C.
Solution:
1. Enter graph at load scale for 390 amp; proceed vertically to intersection with top curve and read 450 Mcm cable required.
2. Follow along top curve to right and at intersection with lower diagonal read 110 C as the maximum allowance copper temperature for the cable.
3. From point on top curve established in Step 1, move horizontally to left vertical scale and read 1.8 v drop per 100 ft of conductor.
4. From same point on top curve, proceed vertically to bracket and read 3½-in. conduit required for the three-conductor 450 Mcm cable.
5. To obtain corresponding values based on another ambient temperature, for example 60 C, refer to table and use 0.79 correction factor. At 60 C ambient temperature the 450 Mcm cable will carry only 0.79 as much current as at 30 C but the load is still 390 amp. To find size of conductor required for this load at 60 C, divide 390 by the correction factor 0.79 and get 493 amp. Find 493 amp on the load scale, proceed vertically at the top curve and read 700 Mcm cable required. Then move to right and find copper temperature will be 110 C. Voltage drop will be 0.79 x 1.8 or 1.42. Conduit size is 4 in. for the three-conductor 700 Mcm cable.
Ambient correction factors
30 C - 1.00 60 C - 0.79
40 C - 0.94 70 C - 0.71
50 C - 0.87 80 C - 0.61
Conduit size
Volts drop for 100 ft of conductor
Load, amperes, 80% pf
Max copper temp.

An Important Consideration

in the reduction of operating and maintenance costs . . .



There is no doubt about it . . . the path to profit lies in reduction of maintenance and operating costs. For the industry as a whole this figure represents 15% of each revenue dollar. Moloney Transformers can help you cut these costs because of:

- Superiority of design that ensures high surge strength and thermal overload capacity.
- Better mechanical features which reduce maintenance operations.
- Long, trouble-free operation due to fabrication by skilled workmen, use of quality materials, and careful processing.

. . . OVER 50 YEARS OF LEADERSHIP IN DESIGN, RESEARCH, ENGINEERING

For PLUS PERFORMANCE specify Moloney Transformers.

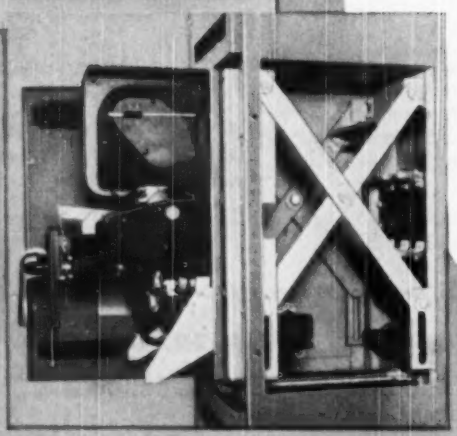
MOLONEY ELECTRIC CO. ☆ ST. LOUIS 20, MO.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

Here's the *best*

I-T-E MULTUMITE SWITCHGEAR FEATURES EASIER ACCESS TO BREAKERS!

On both high- and low-voltage Multumite Switchboards, the easy-to-remove breakers are praised by maintenance men. I-T-E 5KV Breakers are truck-mounted for quick, easy withdrawal from compartments. Low-voltage I-T-E Breakers are pantograph-mounted, and all components are accessible when breaker is withdrawn. In the fully withdrawn position, breaker can easily be removed; the metal feet on its base make it a self-standing unit. Both HV and LV breakers may be tested while still in their compartments.



Send for these descriptive bulletins

BULLETIN 6003-D: A complete reference guide to I-T-E 600V Switchgear assemblies. Contains detailed information on I-T-E Multumite and helpful facts for specifying and ordering complete switchgear installations.

BULLETIN 7000-A: Describes I-T-E's newest 5KV Switchgear — illustrated and supplemented with practical, easy-to-read drawings and diagrams. It you have any questions on modern HV switchgear construction, it will pay you to have this bulletin.

Get both of these helpful bulletins now. Ask your local I-T-E Representative or write I-T-E General Offices.

way to order electrical protection

Let I-T-E supply the complete job!

You'll discover how easy—and economical—solving electrical distribution problems actually is when you put the I-T-E organization to work for you. I-T-E furnishes everything you need in engineering and equipment. For instance, here's what you get when I-T-E supplies your switchgear:

• PROPER APPLICATION FOR YOUR SPECIFIC NEEDS: Every I-T-E Sales Engineer is a *switchgear specialist*—fully qualified to assist you in planning all parts of your distribution system. Thus, your I-T-E Switchgear is designed for your specific problems—built to meet your needs!

• EFFECTIVE, PROPERLY COORDINATED UNITS: I-T-E supplies the finest components for every part of your distribution system. I-T-E's own equipment is designed better to last longer. Purchased auxiliaries must meet highest standards of excellence. And all components are coordinated by I-T-E's engineers into efficient, functional units of maximum dependability.

• QUICK, EASY INSTALLATION: Your I-T-E equipment is completely assembled and tested by I-T-E *before* shipment. It is delivered to you, ready for connections. Installation is simplified; chances of failure because of improper assembly are minimized.

• A SYSTEM THAT'S EASY TO OPERATE, EASY TO MAINTAIN: All components of I-T-E units are functionally arranged for easy, simple operation. And your maintenance men will be enthusiastic when they see how much more *accessible* I-T-E units are. Inspections and maintenance are easier, take less time!

• IT'S EASY TO ORDER, WITH QUALITY GUARANTEED! A *single* order is all it takes for a *complete* I-T-E job—from the simplest panelboard, to everything necessary for a complete distribution system. I-T-E designs, builds, and ships your job as a "package"—and accepts complete responsibility for the operation and performance of every component!

Extra service and extra quality—which you get without extra cost—make I-T-E your best switchgear buy!

I-T-E

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company
19th & Hamilton Streets, Philadelphia 30, Pa.

Power Switching Equipment Division: Railway & Industrial Engineering Co., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto
Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES
CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS
SPECIAL PRODUCTS

Transformer Polarity

Subtractive and additive polarity indicated in single transformers and in delta-delta and wye-wye connected banks of transformers. An adaptation from construction methods of Pacific Power and Light Co, Portland, Oregon

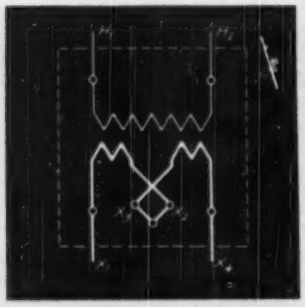


FIG 1—SUBTRACTIVE POLARITY

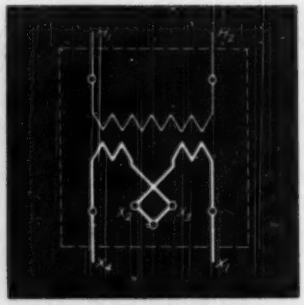


FIG 2—ADDITIVE POLARITY

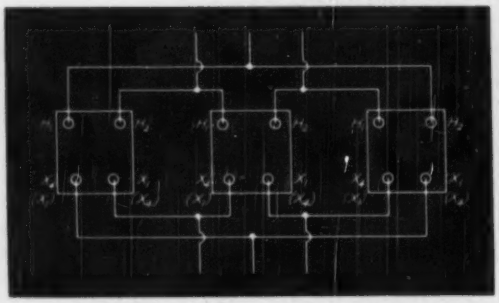


FIG 3—DELTA-DELTA BANK of additive (or subtractive) polarity transformers

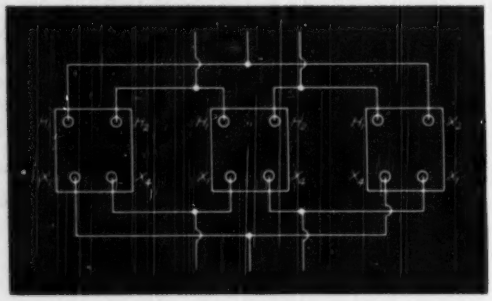


FIG 4—DELTA-DELTA BANK of two subtractive and one additive polarity transformers

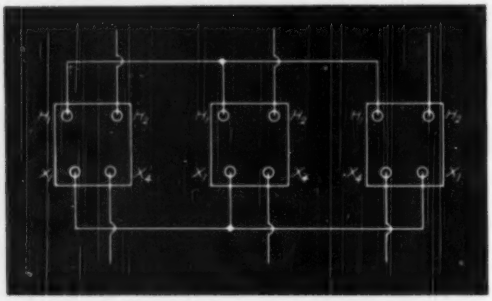
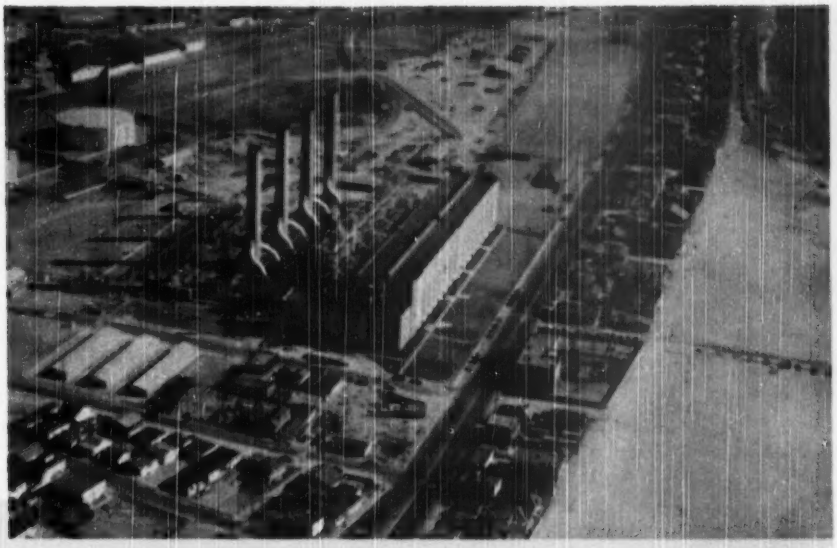
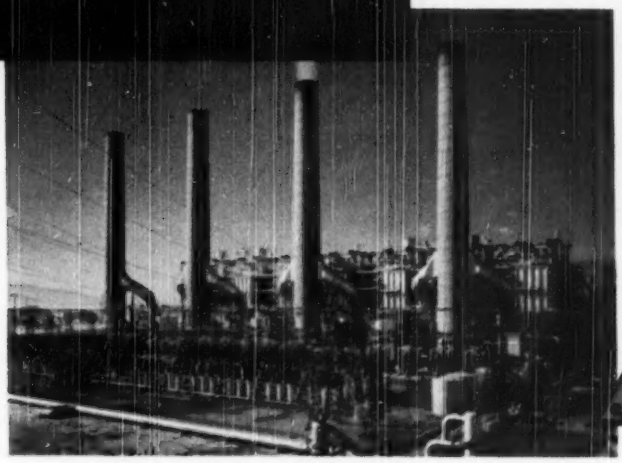


FIG 5—WYE-WYE BANK of two subtractive and one additive polarity transformers



HELPING TO MAKE THE WONDERS *of* SO. CALIFORNIA *more wonderful*

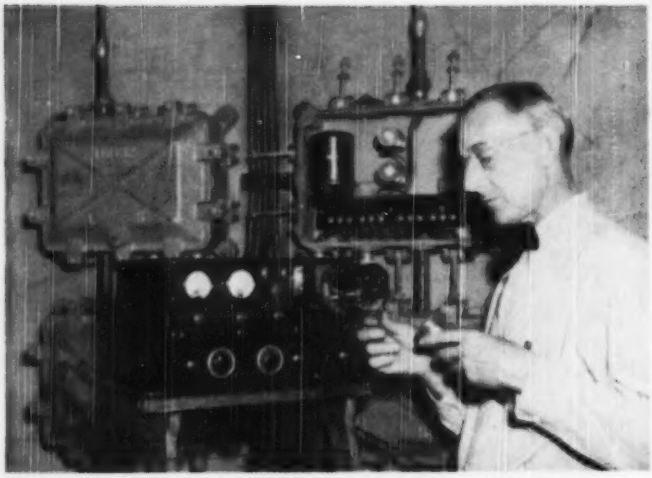


The 280,000 kw Redondo Steam Station was constructed to keep pace with the rapidly growing power demands of this region. Semi-outdoor design combines economy of construction with operating comfort and convenience and the entire structure has been built to resist the stress of possible earthquake shock. Unique is the provision for control of marine growth through thermal shock during periodic reversal of salt water flow in the two 2,000 foot intake and discharge tunnels which obtain condenser circulating water from the Pacific Ocean.

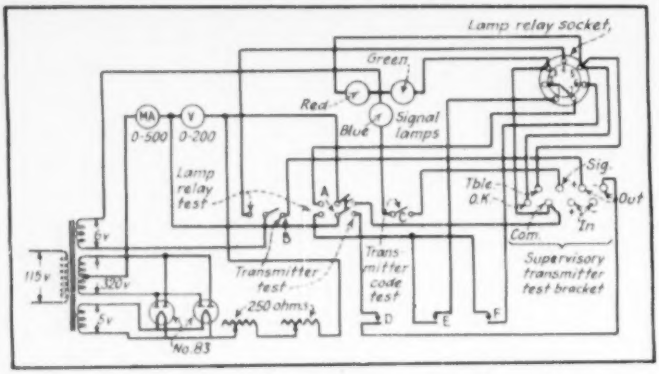
Stone & Webster Engineering Corporation designed and constructed the Redondo Steam Station for Southern California Edison Company.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.



DESIGNER uses portable tester to adjust armature of a supervisory transmitter in a network vault. Test set replaces visual testing and adjusting that resulted in numerous delays



TEST SET has connections for calibrating supervisory equipment from a 115-v ac supply

Tester for Subway Network Supervisory Equipment

JOHN G. HUGHES
Operating Supervisor
Duquesne Light Co
Pittsburgh, Pa.

A SMALL portable tester has recently been constructed to permit rapid testing and accurate calibration of supervisory transmitters and lamp relays. This equipment to be tested is included in a supervisory system on a low tension network in the downtown section of Pittsburgh, Pa. The device can be used where 115-v ac supply is available. Designer is T. J. Baxter, a network mechanic of the Duquesne Light Co.

The tester is built in a micarta box 14x7½x8 in. with a removable cover. Terminals, switches, push buttons, and meters are mounted on the front panel (see illustration).

Component parts of the unit include: (1) Transformer, (2) voltmeter with scale 0-200 v; (3) milliammeter with scale 0-500 ma; (4) lamp relay socket; (5) transmitter test bracket; (6) rectifying tubes No. 83; (7) variable resistors, 250 and 500 ohm; (8) signal lamps; (9) various switches.

The transformer insulated secondaries supply 5 v for tube filaments, 6 v for signal lamps and 320 v, which is rectified to 135 v full wave direct current, for the operating coils of the relays and transmitters. Schematic electrical connections are shown.

To test the operating armature of a transmitter, switches (A) and (B) are closed to the transmitter test positions and the desired voltage is applied to the operating coils by the variable resistors. The tension spring on the armature is adjusted for proper operation at the predetermined voltage setting. To test the signal track, switch (C) is closed and pushbutton switch (D) is operated manually causing the code wheel to move through its cycle and registering the code number of the particular transmitter on the blue signal light.

The lamp relays are tested by closing switches (A) and (B) to the lamp relay test positions and again applying the predetermined voltage to the operating coils by means of the variable resistors. Proper operation of the relay is obtained by adjusting the spring tension on the armature bar. The relay is a double coil type with a pivoted two position, clapper type armature.

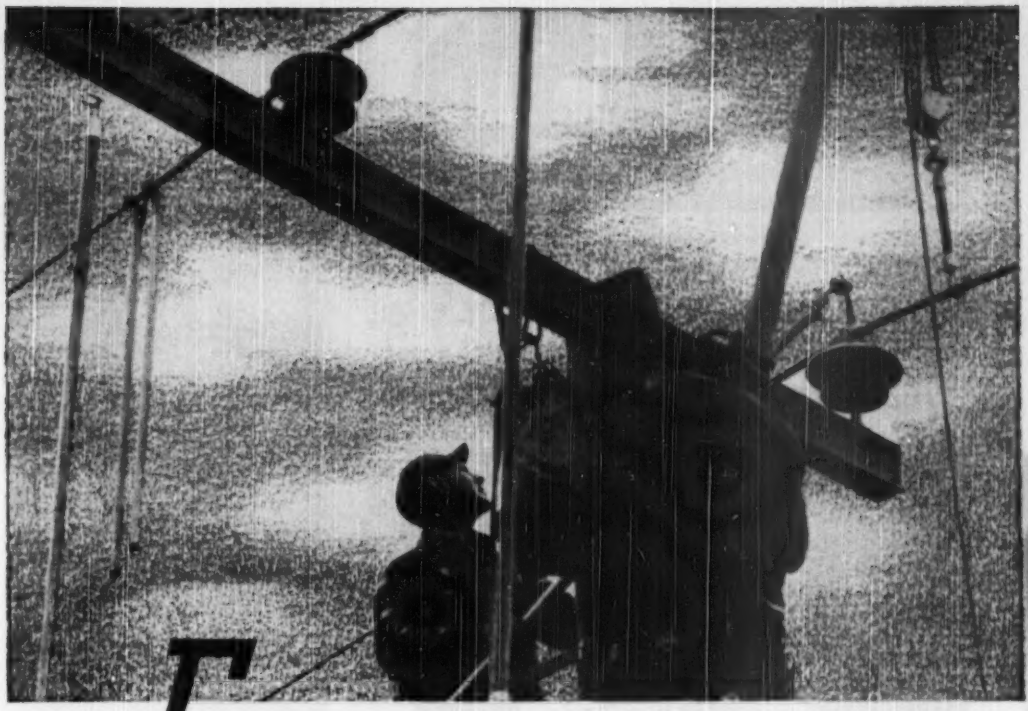
The make and break of the contacts are tested by closing push-button switch (E) which energized the forward relay coil and lights the red signal lamp. By closing push-button switch (F) the rear coil is energized and the contacts are restored to the normal position which is indicated by the green signal lamp.

The Duquesne supervisory system is a three-wire loop type that warns automatically when a transformer has reached a predetermined pressure or temperature, or when a network protector has changed its position.

•

Water Chlorination Frees Workmen

PRIOR to chlorination, condenser tubes were cleaned by Toledo Edison Co with rubber plugs about every month and in addition were chemically cleaned twice a year. After installing chlorination equipment, this work has been completely eliminated. In the past it took four men eight hours to do plugging and five men another 18 hr to chemically clean the condenser.



NO OTHER PINTYPE LIKE AN O-B CLAMPTOP

FOR HOT LINE WORK

One of the most difficult jobs to do with a hot stick is the installation of an approved permanent tie wire. Not only is it slow and demanding of unusual skill, but the loose ends of an eight- to ten-foot energized tie wire are a menace to linemen. This operation can be cut to a few minutes' time--*safe minutes!*

Because O-B Clamptop insulators substitute a simple bolted clamp for the conventional tie connection, all the danger and difficulty of an energized tie wire disappear. Cable is lowered into the seat, the keeperpiece positioned, and two hex nuts drawn down. This is all there is to it. It's just as simple as it sounds. Just as safe. Just as fast.

Holding power of the O-B Clamptop is the same, installed hot or cold. The insulator will develop a cantilever strength of 2,000 to 2,400 pounds and will not lose this grip through strain or vibration.

Specify O-B Clamptops on a trial installation and see for yourself their speed and safety.

Ohio Brass

MANSFIELD • OHIO

3077-H

EISLER TRANSFORMERS

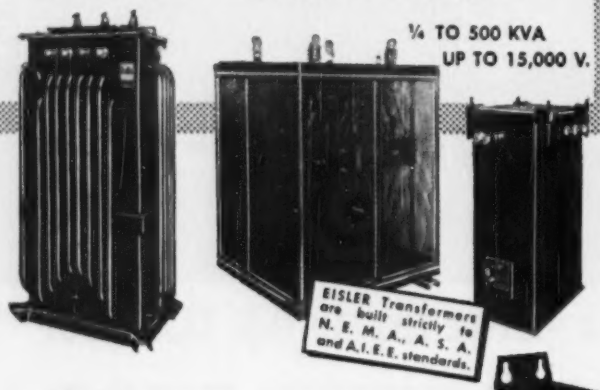
STANDARD • SPECIAL

AIR • OIL • WATER-COOLED

for

POWER DISTRIBUTION • LIGHTING •
AUTO • ELECTRIC FURNACE •
HEATING • PHASE CHANGING •
WELDING • GENERAL PURPOSE

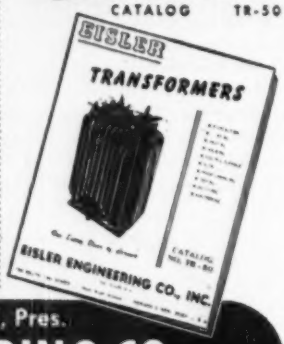
¼ TO 500 KVA
UP TO 15,000 V.



EISLER Transformers are built strictly to N. E. M. A., A. S. A. and A. I. E. E. standards.

In addition to the manufacture of standard transformers the Eisler organization is especially well adapted to design and build transformers to the customer's specifications when departure from standard construction is desired. Send in your specification for quotations.

SEND FOR NEW CATALOG TR-50



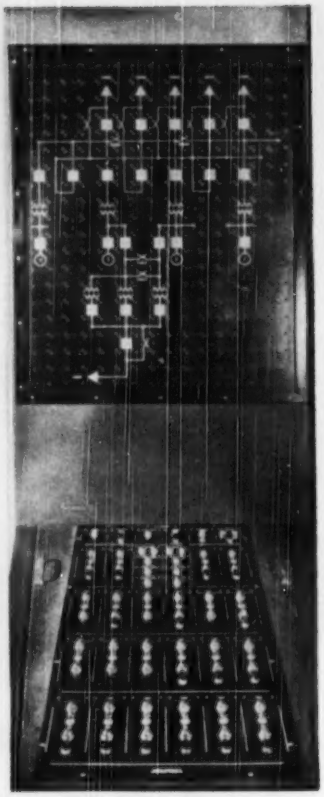
EISLER
RESISTANCE WELDERS
SPOT • BUTT • GUN • SEAM

A complete line of Resistance Welders from ¼ to 300 KVA for all types of welding.

CHAS. EISLER, Pres.

EISLER ENGINEERING CO. INC.

769 SOUTH 13th ST. NEWARK 3, N. J., U. S. A.



LIGHTED SYSTEM DIAGRAM used in conjunction with supervisory control gives El Paso dispatcher a graphic picture of system operation at all times. Translucent symbols for system components can be added in blank spaces as the system grows

Faster Dispatching With Lighted System Diagram

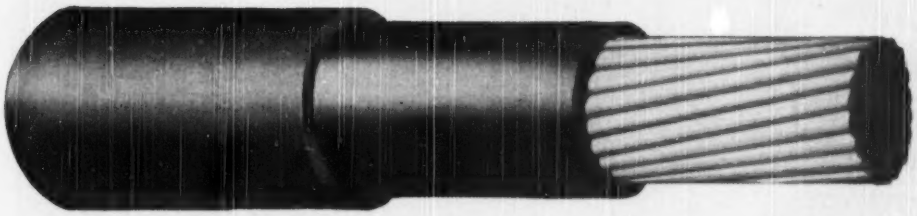
FASTER recognition and interpretation of system disturbances is provided dispatchers by a lighted system map recently installed by El Paso Electric Co. Major units of the transmission system from generator to substation breaker are shown on it as a schematic diagram. Small light globes behind translucent symbols of system components automatically indicate at a glance those that are energized.

Individual unit sections of the board are replaceable with standard symbols, so the map can be modified at any time to conform to system growth or changes. Designed primarily to be used with supervisory

Famous since 1932...

Better than ever Today

Time-tested since 1932 under all service conditions, subsequent improvements provide additional security in this long-famous network cable.



ANW
Anaconda Net Work

Tough, easily handled, Type ANW-insulated, neoprene-jacketed cable incorporates six important advantages . . . important to you for underground duct installation.

1. Better heat and flame resistance – protected by the same neoprene jacket as Anaconda mining cables which must and do meet the severe flame test of the U.S. Bureau of Mines.

2. Higher resistance to duct acids and alkalies – years of experience with Type ANW insulation with only a braid covering showed it to be highly resistant to oils, acids and alkalies encountered in soil and sewage waters. NOW it has the additional protection of the neoprene jacket which itself has shown by test and experience, excellent resistance to these agents of destruction.

3. Higher operating temperature – now 75 C copper temperature, continuous duty.

4. Superior aging – Type ANW insulation has demonstrated year after year . . . and now even better . . . long-aging characteristics under severe oxygen bomb and air bomb tests.

5. Low moisture absorption – Type ANW insulation has always had low moisture absorption . . . far less than is detrimental to safe operation.

6. More easily handled – passes 180 degree cold-bend test at 0° C without damage to jacket. Cable is lighter, easier to pull. No lead to fuse, insulation and jacket do not support combustion.

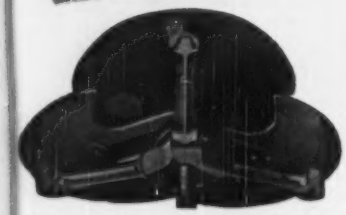
ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4, N. Y.

EVERSTICK ANCHORS...

First Choice for

PERMANENCE
HOLDING POWER
LONG LIFE
SAFETY



They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

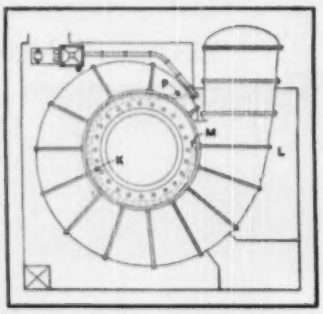
AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "The Anchor of Merit"
FAIRFIELD, IOWA

control equipment, the map adds only 10–15% to the cost of such equipment, since the necessary relays and contacts are already available.

In operation the electric map helps new or comparatively inexperienced operators visualize the transmission system and interpret troubles in relation to the overall system. For the veteran operator it provides a quick and positive verification of his analysis of the trouble as indicated by the supervisory control indicating lights.

•



SPIRAL PIPE (PKM) is cut off in sections as it places concrete around large scroll cases at Grand Coulee. Area "L" outside scroll is sealed off with "elephant trunks" slightly ahead of the inner pour

Spiral Pipe Places Concrete for $2,000 Less

JAMES E. MOTSENBOCKER
U. S. Bureau of Reclamation, Coulee Dam

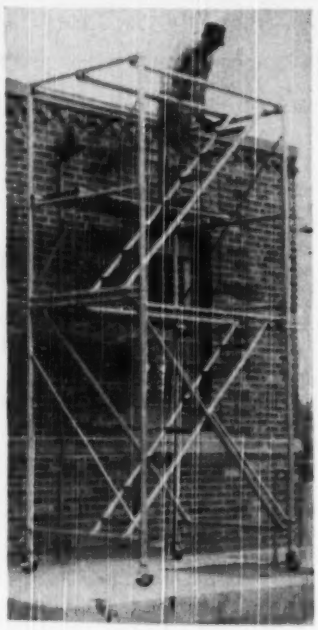
SPIRAL PIPE, which is cut off in sections as a concrete pour progresses, has reduced by at least $2,000 time and material costs for embedding in concrete large scroll cases at Grand Coulee Dam. The pipe is fabricated from sections of 8-in. spiral-welded pipe, and laid around the inside of the scroll case spiral as shown. During operation it is connected to a standard pipe from a "pumpcrete" machine conveniently located slightly above and to one side of the concreting operation.

When sufficient concrete has been deposited from the end of the special pipe, the pumping action is shut off momentarily and the pipe cut off with a torch a few feet from the end. The operation is repeated, the concrete placing crew backing out as the space beneath and alongside the scroll case is filled to the height of the pipe. The pipe is cut at intervals as needed so as to facilitate placing and working of the concrete in an orderly manner.

Because of the varying size and shape of the scroll case, concrete must be placed in varying depths or lifts to prevent excessive drifting or lifting pressures against it. Concrete is first placed outside and below the scroll case, leaving sufficient space for a secondary, or seal-off lift from outside to inside. Seal-off is done with concrete buckets equipped with "elephant trunks" starting with area "L" as shown and progressing clockwise around the casing. As soon as the seal-off lift is well under way the pumpcrete machine starts delivering concrete through the pipe, and the dual operation of placing concrete continues with the seal-off lift outside the scroll case slightly in advance of the pumpcreting operation.

•

Aluminum Scaffold Makes Light Work



INSTEAD OF working from ladders or improvised supports, men in various departments of Cleveland Electric Illuminating Co have found it more convenient and safe to set up the light weight scaffold shown. It weighs about 70 lb and can be assembled by one man in 2 to 3 min

Don't Shell Out for Shell Rot!

Use penta-chlorophenol protected POLES

PENTAchlorophenol is your answer to costly shell rot! Because PENTA is a *clean* wood preservative, full length protection of *all* poles is now possible.

PENTA-treatment helps stop costly shaving or premature pole removals due to shell rot, by giving effective protection against decay and termites. The low solubility and volatility of PENTAchlorophenol make it last for years.

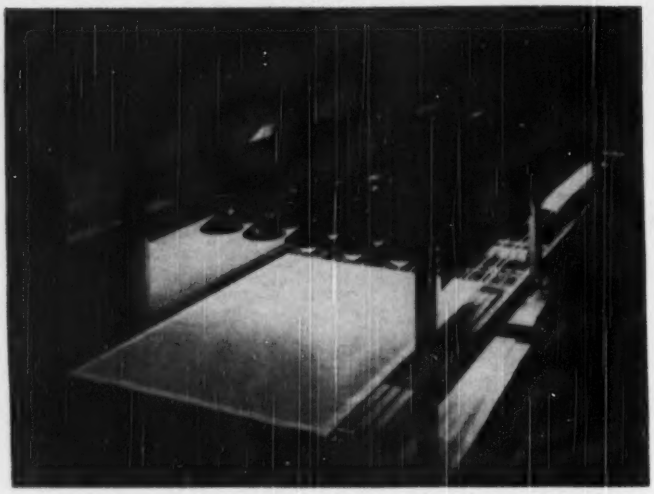
Find out how PENTA can cut your pole maintenance costs. Write directly to Dow, Dept. PE 21.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

DOW
penta-
chlorophenol

LOAD BUILDING

RESIDENTIAL • RURAL
COMMERCIAL • INDUSTRIAL



DRYING PAINT on advertising posters with 100 infrared 250-w, G-30 lamps in gold plated reflectors. Drying time, which formerly required up to two hours, was cut to less than two minutes. Induced draft fan removes paint vapors. Switching arrangement permits heat to be applied to different sections of poster as needed. Posters formerly were dried on racks.

Infrared Cuts Drying Time on Painted Posters

A. N. REGOTTAZ
Industrial & Commercial Div
New Orleans Public Service Inc

A PRODUCTION bottleneck was eliminated by the Snider Poster Process Co of New Orleans, La., with the use of infrared lamps to dry the paint on posters. Drying time, which formerly required up to two hours, was cut to less than two minutes.

The company produces advertising posters which range from the small card type, that appear in show windows and on counters, to the large billboard type consisting of ten individual sheets, each 44x60 in.

All work is done by a stencilling operation known as the silk screen process. Oil base paints are used exclusively. After each color has been stenciled on a poster, the paint has to dry sufficiently before it can be stacked and the next color applied. Prior to the installation of infrared, these posters were hung on racks to dry. Drying time depended on the temperature and humidity of the air.

Air temperature and humidity makes little or no difference in drying time with the new infrared bank. The heat energy is furnished by one hundred, 250-w, G-30 type lamps. Each lamp is screwed, base up, into a gold plated reflector. A variable speed conveyor belt (12 to 20 fpm), 4 ft in width, carries the posters through the drying bank. Heat is applied during the first 15 ft of travel; for the next 38 ft, the poster cools and air-dries sufficiently to be stacked automatically. An induced draft fan removes the paint vapors liberated during the drying process. The switching arrangement for the lamps is particularly flexible, enabling the operator to apply heat to different sections of the poster as needed.

The company's management is pleased with this installation because it has enabled a substantial increase in their productive output, reduction in space requirement and better quality of work. They can now contract for more and larger jobs, thanks to infrared.

Toledo Edison Increases Commercial Cooking Sales

A KW INCREASE of about 20% over 1948 first-half figures for commercial electric cooking equipment sales was registered by The Toledo Edison Co. Two hundred and seventy-two individual cooking appliances, amounting to 892 kw, were sold through company sales efforts between January and June of last year, as compared with 84 sales accounting for 745.3 kw during the like 1948 period.

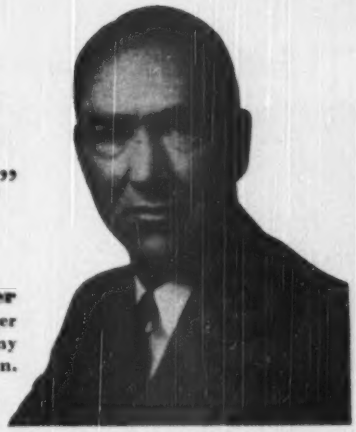
New load was added at an average of 0.655 kw per call. In addition to 1,362 calls (1,230 customer, 126 dealer, and 6 miscellaneous), sales efforts included 29 leads given dealers and nine special meetings. Commercial cooking establishments were sent 9,629 copies of the company's "Food Service News."

The accompanying table indicates no decline in the commercial cooking market, provided an energetic sales effort is made.

Comparison of Commercial Electric Cooking Equipment Sales, 1948-1949

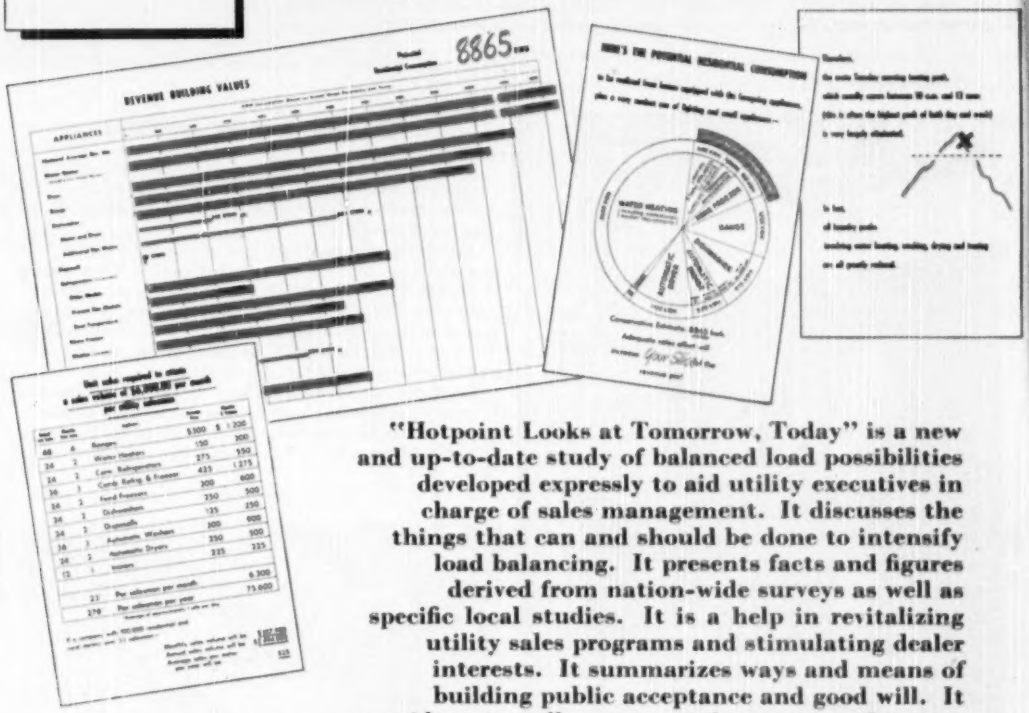
Appliance	Jan-June 1948 No.	Kw	Jan-June 1949 No.	Kw
Dripolators	20	6.0	18	5.4
Coffee Makers	61	130.2	56	97.8
Coffee Urns	3	14.0	22	114.0
Food Warmers	29	35.3	14	30.5
Roll Warmers	5	5.3	4	3.4
Toasters	32	72.1	37	77.1
Ranges	1	12.0	2	43.8
Ovens	1	12.0	1	12.6
Broilers			1	16.5
Hot Plates	15	38.0	12	31.2
Grills	5	24.0	8	30.5
Griddles	22	74.5	21	81.3
Fry Kettles	41	213.5	45	231.8
Dishwashers	16	7.6	9	12.1
Waffle Bakers	5	7.8	8	12.4
Steamers	8	6.7	14	9.8
Miscellaneous	....	18.5	....	0.8
		677.5		811.0
Marginal error at 10%	....	67.8		81.0
Total	....	745.3		892.0

"A well-rounded presentation that recognizes aggressive selling as the foundation of the industry's strength."



R. F. Pulver
Vice President and General Sales Manager
Minnesota Power and Light Company
Duluth, Minn.

Your opinion is greatly appreciated, Mr. Pulver. Incidentally, more and more utility sales executives are asking to see this study.



"Hotpoint Looks at Tomorrow, Today" is a new and up-to-date study of balanced load possibilities developed expressly to aid utility executives in charge of sales management. It discusses the things that can and should be done to intensify load balancing. It presents facts and figures derived from nation-wide surveys as well as specific local studies. It is a help in revitalizing utility sales programs and stimulating dealer interests. It summarizes ways and means of building public acceptance and good will. It provides an excellent means of comparison between your methods and those of other utilities throughout the country. ***Executives who are interested in seeing this timely, helpful analysis are requested to contact Hotpoint Utility Division, Hotpoint, Inc., 5600 West Taylor Street, Chicago 44, Ill.***

Hotpoint Inc.
(A GENERAL ELECTRIC AFFILIATE)

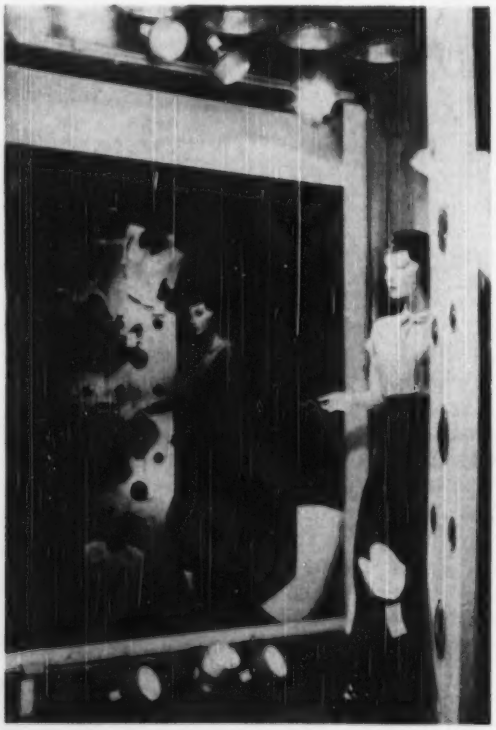
Self-Service Counter for Lamps Saves Customer Time

1 MRS. D. J. MINOR, customer of The United Illuminating Co, New Haven, Ct, just paid her electric bill and is about to leave the office. Her attention is arrested near the door by large, easel-mounted poster, announcing the company's new, convenient self-service lamp bulb counter. She decides that she ought to investigate

2 AT THE SELF-SERVICE CENTER, Mrs. Minor scrutinizes the various offerings and makes her selection. Each kit, all ready for delivery, is tagged with description of the contents and total price including Federal excise and state taxes. Larger kits are in attractive cartons; lower-priced kits (containing 3 or 4 bulbs) are in grocery bags.

3 AT LAMP COUNTER, though two customers are ahead of her, Mrs. Minor is able to deposit the full amount of her purchase in a self-service cash box, presided over by a plastic figure of Reddy Kilowatt. She leaves without delay. If extra change is needed she obtains it from the clerk or from a nearby cashier's window

• • •



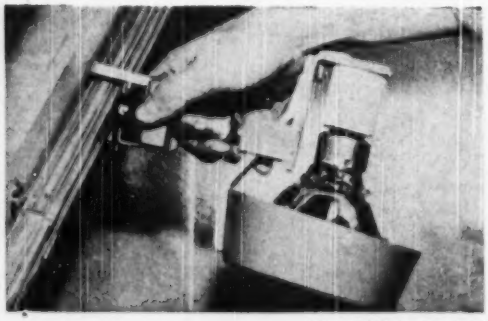
DISPLAY LIGHTING can be plugged in along three sides of window

Flexible Display Lighting

For store window and display illumination where frequent changes in lighting layout are to be expected, an adaptation has been made of continuous plug-in duct such as used in factory installations.

The duct is a standardized and pre-fabricated wiring system which can be installed easily and quickly. When display needs call for the addition of more fixtures or the rearrangement of individual units, they can be snapped on by a layman at any point in the duct without any new electrical work. Flood or spot lights can also be added at will, and all units can be beamed in any direction needed.

Illustrated is a recent installation in the window lighting of Hearn's department store in New York. Here is used a fixture which is adaptable for the R-30 lamp, the Par lamp, or any R-40 lamp up to 500, all in conjunction with color filters.



(General Lighting Co photo)

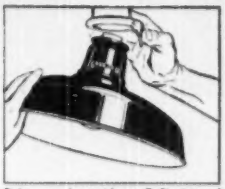
LIGHT is attached to plug-in duct by window trimmer at desired spot

APPLETON DISKONECT REFLECTORS

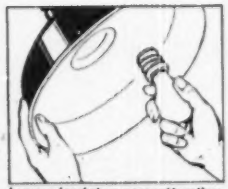
the most practical DETACHABLE REFLECTORS ever made!

Pat. No. 1,993,385

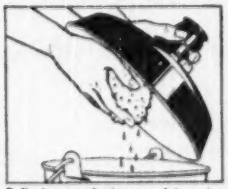
5 SIMPLE STEPS FOR EASIER SERVICING



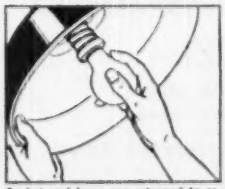
Release spring-set lever. Reflector and lamp are detached instantly, as a unit.



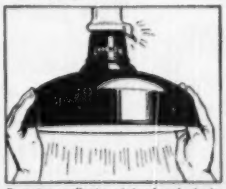
Lamp and socket are removed together. Slight upward pressure and a quarter turn remove them from reflector.



Reflector may be immersed in water for thorough cleaning to restore original reflecting surfaces.



Socket and lamp are returned to reflector and securely locked with merely a simple twist of the wrist.



Pressing reflector into hood, locks reflector in place, lights lamp, again delivers full illuminating efficiency.

Here's Appleton's answer to the ever-present problem of installing and servicing light reflectors quickly and easily. The Diskonect Reflector is attached or detached from the hood instantly by means of a snap lock—without twisting, tugging, forcing or the use of tools. The heavy drawn-steel hood is fitted with a spring-set lever which locks or unlocks the porcelain enameled reflector.

Even when the Diskonect Reflector remains in place for extended periods, detachment remains quick and easy. Corrosion and "freezing" together of component parts are prevented by metal-to-glass connection—heavy, rustless cadmium plate to porcelain enamel.

Diskonect Reflectors are finished in permanent porcelain enamel and offered in a wide variety of styles. Complete "come-apart" construction permits cleansing of all parts separately a time-saving feature that enables you to maintain a higher standard of lighting efficiency. Write for catalogue information.

SOLD THROUGH ELECTRICAL WHOLESALERS

APPLETON ELECTRIC COMPANY

1705 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Mission St. • ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Avenue • ATLANTA, 724 Boulevard, N.E. • BIRMINGHAM, 429 Brown-Marx Bldg. • MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 East Pleasant, St. • BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street.

Resident Representatives: Cincinnati, Dallas, Houston, Indianapolis, Kansas City, Milwaukee, Seattle

Export Representatives: International Standard Electric Corp., 67 Broad St., New York 4, N. Y.

APPLETON ELECTRIC PRODUCTS

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

now ALL GUTH for 4-foot

✚ *LIGHT AT THE FLICK OF THE SWITCH*

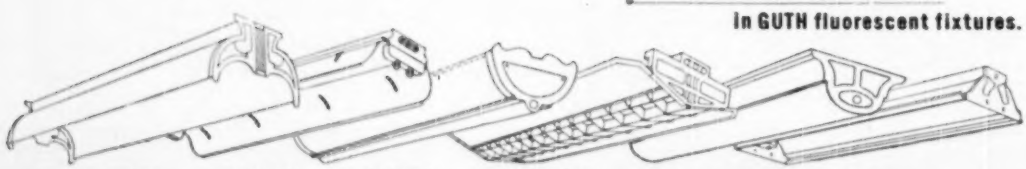
✚ *NO STARTERS*

Here's the biggest fluorescent news in years: you can now use the new 4-ft., 425 ma. T-12 Slimline Lamps in every fixture of the entire GUTH fluorescent line. And the 4-ft. Slimline is efficient! Same lumen output per foot as the 8-ft. Slimline.

Now you have your choice:

- **the 4-ft. Slimline**
- **the 8-ft. Slimline**
- **standard 40-W lamps**
- **standard 85-W lamps**

in GUTH fluorescent fixtures.



FUTURLITER* MAZELITE* CADET* ARISTOLITE* FLU-O-INDIRECT* TROFFERS

FIXTURES

SLIMLINE LAMPS

✚ EASY TO HANDLE

**For full details,
call your nearest GUTH resident engineer or write**

YOUR TEAMMATE IN *precision-planned* LIGHTING

TRUCOLITE •

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

143

No. 822 is a one-and-only!

. . . it's a revolutionary laboratory development . . . the only *oriented plastic* backing with a successful pressure-sensitive adhesive mass.

No. 822 is a single material!

. . . completely eliminates costly packs, wraps, oily dielectrics on primary splices.

No. 822 is applied quickly!

. . . easily hand-wrapped directly over the splice. Clean, simple, completely efficient. One material . . . one quick operation.

No. 822 is 10,000 volts strong!

. . . only 9 mils thick yet with over 10,000 volts dielectric strength. Power factor .0050 (10^6 cycles). Insulation resistance greater than 8×10^8 megohms. Dielectric constant 2.6. Exceptional corona quenching characteristics.

No. 822 is moisture-, solvent-, corrosion-proof!

No known solvent for backing at room temperature. No measurable corrosion effect. Water transmission rate 0.24 gms per 100 sq. in. in 24 hrs. continuous immersion.

No. 822 is versatile!

Literally hundreds of uses . . . splicing, wrapping, insulating, corrosion coating of cables, wires, controls, pipes, conducts or what have you?

No. 822 samples are free!

WRITE TODAY for your sample, complete specifications and engineering data. Address POLYKEN, Dept. 5-2, 222 W. Adams Street, Chicago 6, Illinois.

Polyken®
INDUSTRIAL TAPE
DEPARTMENT OF
BAUER & BLACK
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

INDUSTRIAL BRIEFS

Electric Heat Drys Bottles. The Emerson Drug Co of Baltimore, Md., uses all-electric equipment to remove all moisture from bottles before filling.

Thoroughly cleaned and blown out with clean dry air, bottles are conveyed 10 ft to filling machines—safeguarded by glassed-in enclosures employing metallic type infrared electric heaters totaling 3.8 kw having special voltage controls to ensure proper temperature conditions. Heaters keep bottles about 10 deg above room temperature which prevents moisture from re-entering and effects a vacuum seal after filling.

Two 25-hp compressors supply air at 65 lb pressure. A 12.5-kw self-contained heating element provides a temperature of 250 deg to drive off water from silica gel dehydrating agent. The dry compressed air is piped from the basement to an upper floor where four 3-kw electrically heated units raise its temperature to 225 deg. The air is then passed on to the cleaning machines.

From the Electric Heating Bureau of the Industrial Power Dept—Gas & Electric Co, Baltimore, Md.

Heaters Set Cement in bases of metal-glass TV tubes. Eight 230-v, 3,600-w radiant heaters, horizontally mounted, four on each side of a flat belt conveyor carrying the inverted Kinescopes, completely dry the cement used to seal the ends of the tubes in one pass. Only the base of each tube is heated.

This method is simple and positive; radiant heaters provide no glare to annoy personnel and installation requires small capital investment.

Infrared Dries Sand Molds quicker and cheaper at the Modern Brass Foundry, Phila. A battery of 32 375-w infrared reflector lamps is used for skin-drying molds used for casting bronze and brass.

Only 15 min. are required to dry the molds to a depth of one-half in. Another type of baking oven which was purchased for the work required approximately 5 hrs. Initial equipment costs were about one-tenth the cost of the competitive equipment.

Electric Ranges with Beauty and Brains

THE *1950* CROSLEY LINE

The beautiful new Crosley Electric Ranges are some of your best *salesmen*—selling families on the many advantages of electricity in the home. Not only do they demonstrate the value of cleaner, cooler, faster cooking, but they help to sell other electric products as well.

The versatile Crosley Electric Range line is designed to convert *more* families to the convenience of electric cooking – because there's a model to meet *every* demand:

Divided tops or cluster tops
Double ovens or single ovens
Full sizes or compact apartment models
Fully automatic or manually controlled ovens

Just a few of the 33 big features that make Crosley easy to sell . . .

- **7 heat speeds to provide exact heat desired**
- **Removable reflector pans for easy cleaning**
- **Huge ovens, with self-sealing, self-adjusting doors**
- **Deep-well cooker that converts to extra surface unit**
- **Drawers with lifetime lubricated bearings**
- **High-speed broiler with specially designed rack**

7

BEAUTIFUL MODELS TO CHOOSE FROM

—and

OF COURSE, THEY'RE *ELECTRIC!*

For complete details about Crosley Electric products, contact your nearest Crosley Distributor, or write:

Crosley Division
Avco Manufacturing Corporation
1329 Arlington Street
Cincinnati 25, Ohio

COD-O
Custom double-oven model with divided top

DESIGNED FROM THE WOMAN'S ANGLE

CROSLEY *Electric* RANGES

AVCO

CROSLEY—BETTER PRODUCTS FOR HAPPIER LIVING

SHELVADOR® REFRIGERATORS ★ FREEZERS ★ ELECTRIC RANGES ★ STEEL KITCHEN CABINETS ★ SINKS ★ GARBAGE DISPOSERS ★ ELECTRIC WATER HEATERS ★ RADIOS ★ TELEVISION

NEW EQUIPMENT

Fault Locator

LOCATION from the substation of faults in power and communication cable may be accomplished with the Telemetron, an electronic power supply developed for use with the Telemetroscope pulse-type fault locator. The equipment, using a high voltage, establishes a spark at the fault and then maintains an arc through use of lower voltage and constant current. Because of the low impedance of the arc, the fault can be located as would a low-resistance ground or short.

Other features include means for high-potential test, capacitor discharge across ball gap for fault breakdown, and constant dc of 10 amp. Dc voltage ratings available are 0–50,000 (shown above), 0–25,000, 0–10,000, 1,000 and 500 v.

Tobe Deutschmann Corp, Providence Highway, Norwood, Mass.

•

Variable Transformers

A DIECAST aluminum terminal box and a new fusing arrangement are featured on the cord-plug models of the Powerstat variable autotransformers, Types 116 and 210. Type 116 operates from 115 v, 50/60 cycles, to deliver 0-135 v, 7.5 amp. Output of Type 210 is 0-270 v, 3.0 amp from 230 v, 50/60 cycles, 1-ph.

The Superior Electric Co, Hannon Ave, Bristol, Conn.

•

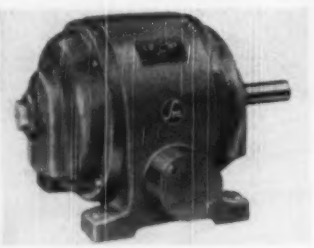
Acidity Test Kit

PREDICTION as to when the oil in a transformer is expected to deposit sludge is said to be possible in a matter of minutes by use of an acidity test kit which can be used in the field.

The neutralizing KOH is in single measured doses in sealed ampules to insure an accurate measure and prevent loss of strength from contact with the atmosphere. The ampules are made in three values: 0.3, 0.6, and 1.5 (mg of KOH per gram of oil sample). A table is furnished from which the actual acidity can be determined from the ampule value within fairly close limits in the range from 0.1 mg to 1.5 mg.

The Gerin Corp, Red Bank, N. J.

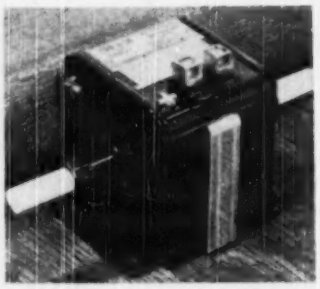
•



Splash-Proof Motors

DESIGNED for locations subject to direct streams of water or other liquids is a new splash-proof motor. Its splash-proof features are said to be retained when it is mounted in any position. End bells permit free passage of ventilating air through integrally-cast baffles, preventing splashing liquids reaching the motor interior. Water and foreign materials are reportedly blown away from the motor and the driven assembly because the air is drawn through the rear of the motor and exhausted through the shaft. Motor is available in ratings from ½ to 30 hp, 208, 220/440, or 550 v.

Sterling Electric Motors, Inc, Telegraph Rd, Los Angeles 22, Calif.



Current Transformers

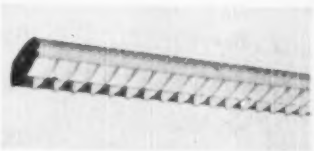
INDOOR, through-type current transformers, Type MR, are available for low-voltage metering indoors with or without thermal demand meters. They are for operation up to 600 v with primary current ratings of 200 or 400 amp to 5 amp. A three-wire transformer may also be had with a ratio of 200-200 to 5 amp.

They are claimed to have high accuracy with ASA class 0.3 at burden B-0.1 and a continuous current rating of 200% while not exceeding a temperature rise of 55 C. Because accuracy is reportedly maintained over this entire current span, only two current transformers, 200 and 400 amp ratings, are required to meter in the complete range from 10 to 800 amp.

No short-circuiting device is used since the open-circuit voltage under full load is only about 10 v. Secondary terminals have solderless connectors that will accommodate No. 6 to No. 14 conductor. Transformers are designed for mounting in any position in a meter box or on a switchboard.

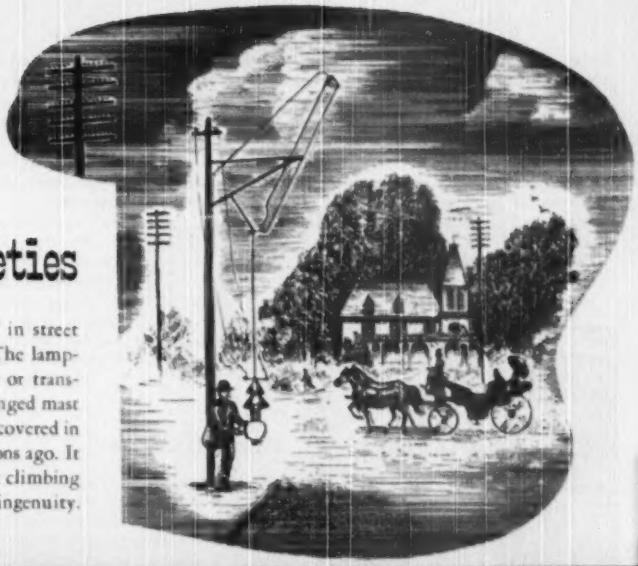
Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh, 30, Pa.

•



Fluorescent Fixture

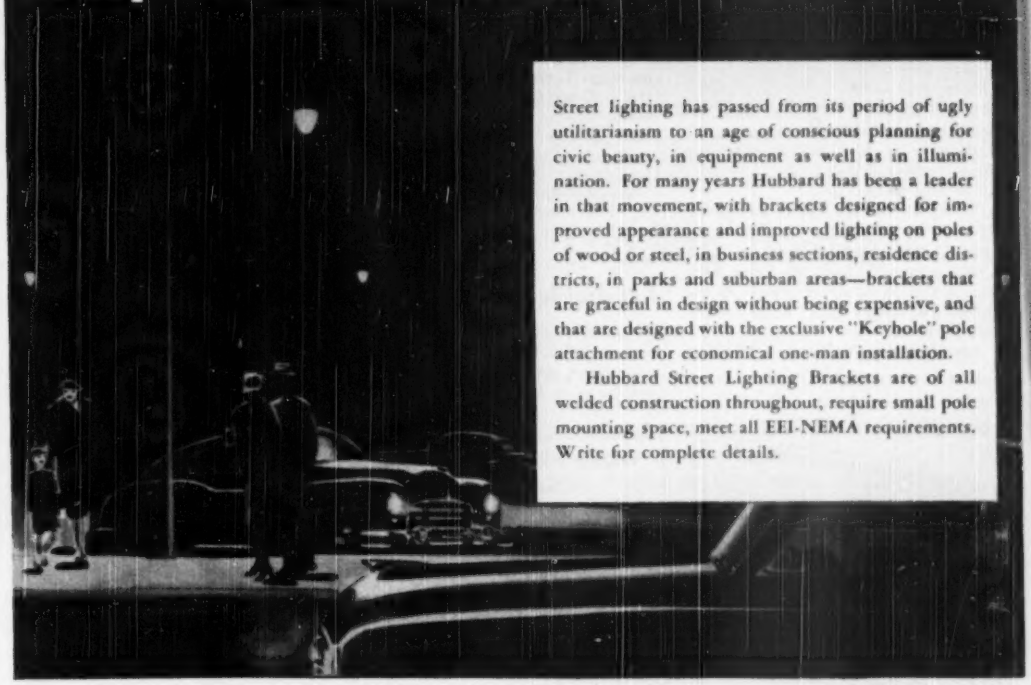
THE CONSTRUCTION of a new slim fluorescent fixture is said to permit simplified relamping, cleaning, and ballast replacement. A deep baffle-type



In the Gay Nineties

The new marvel of the "Gay Nineties" in street lighting was the electric carbon lamp. The lamplighter was rapidly being superseded by or transformed into the carbon trimmer. The hinged mast arm which is shown in the sketch was discovered in an electrical publication of two generations ago. It allowed him to perform his task without climbing the pole and was the last word in Yankee ingenuity.

Today... Thanks to HUBBARD ENGINEERING



Street lighting has passed from its period of ugly utilitarianism to an age of conscious planning for civic beauty, in equipment as well as in illumination. For many years Hubbard has been a leader in that movement, with brackets designed for improved appearance and improved lighting on poles of wood or steel, in business sections, residence districts, in parks and suburban areas—brackets that are graceful in design without being expensive, and that are designed with the exclusive "Keyhole" pole attachment for economical one-man installation.

Hubbard Street Lighting Brackets are of all welded construction throughout, require small pole mounting space, meet all EEI-NEMA requirements. Write for complete details.

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH CHICAGO OAKLAND, CALIF.

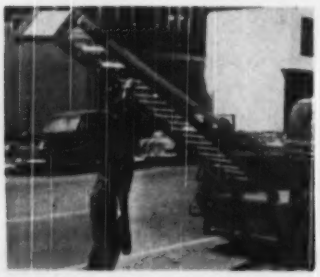
HANG THE LOAD ON HUBBARD HARDWARE

louver, with ribbed plastic sides held in place by three acorn nuts, also serves as the cover plate for the wiring channel. Louver and sides are readily removable.

Reflectivity is given as 89% with an ETL efficiency rating of 84%. The Fleetline fixture can be mounted continuously, or pendant mounted, and is available in both 8 and 4-ft lengths for single-pin slim T12 lamps.

Cornwall Fixture Co, Cornwall, N. Y.

•



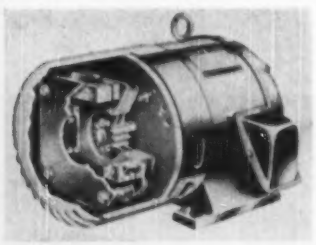
Service Ladder

AN aluminum service ladder mounted on the truck bed suffices to convert an ordinary truck into a luminaire service unit. Luminaires can be serviced even though automobiles are parked in the vicinity because the ladder is mounted at an 18-deg angle from the rear of the truck bed. With this arrangement, the truck may be positioned in either the street (perpendicular to the curb line) or parallel to the curb.

There are two sections to the ladder, 12 and 14 ft, which, when fully extended, reach luminaires up to 25 ft from the ground. Eight insulating units are located at strategic points on the ladder and ladder guys. Weight of the unit is 117 lb.

Line Material Co, Milwaukee 1, Wis.

•



Brake Motor

BRAKING DISKS of an improved brake motor are now mounted closer to the motor with a shorter shaft to minimize strain and wear on shaft and bearings. Magnets are located away from the motor for increased heat dissipation and tension springs are mounted on main brake studs for greater accessibility. Number of braking surfaces and types of magnet coils and actuating springs can be varied to meet special braking torque requirements.

There are seven basic brake sizes for frames 151 to 505, with horsepower ratings from ½ to 100 hp at standard ac and dc voltages. Continuous torque ratings are from 1½ to 300 lb-ft; intermittent ratings from 2¼ to 450 lb-ft.

Star Electric Motor Co, Bloomfield Ave & Grove Sts, Bloomfield, N. J.

•

Flame Detector

INSTANTANEOUS response to flame conditions to prevent a discharge of unburned fuel to combustion chambers, and shut off the fuel supply in event of failure, is claimed for a flame detector used with oil or gas fired burners. Known as a Protectoglo, it operates on flame rectification principles. The system applies alternating current to either a flame-electrode immersed in the flame, or to a photocell sighted at the flame, to rectify the current.

The detector can be interlocked with any needed combination of control devices and accessory equipment such as excess-pressure and low-water safety cutoff or temperature controls. It is applicable to single or multiple burner installations.

Minneapolis-Honeywell Regulator Co, 2953 Fourth Ave, S, Minneapolis 8, Minn.

•

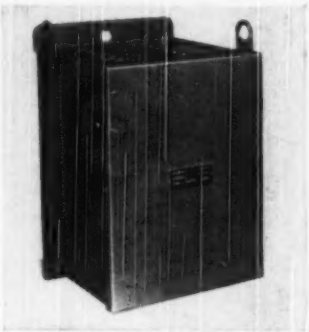
Adjustable-Speed Drive

STEPLESS speed selection and adjustment at 290-2,300 rpm for rated output and as low as 80 rpm for short periods, or at light load, is said to be possible with the VS drive. Other functions performed by the unit are reported to include quick, smooth starting and stopping; jogging and creeping speeds; and centralized control at the machine or remote locations.

The drive consists of four basic components: (1) A drive motor rated ¾, 1, 1½, or 2 hp, 1-ph; (2) an operator's control station with start-stop pushbuttons, run-job selector switch, and speed adjuster; (3) a control unit which provides controlled electronic rectification and includes enclosed contactors and overload relays.

Reliance Electric & Engineering Co, 1111 Ivanhoe Rd, Cleveland 10, Ohio

•



Lighting Transformers

DRY TYPE general purpose lighting transformers incorporate physical changes said to permit greater circulation of air to bring about lower operating temperatures. The number of knockouts has been increased over previous models to facilitate wiring of

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

AUXILIARY MOTOR
For driving power station auxiliaries mounted out-of-doors

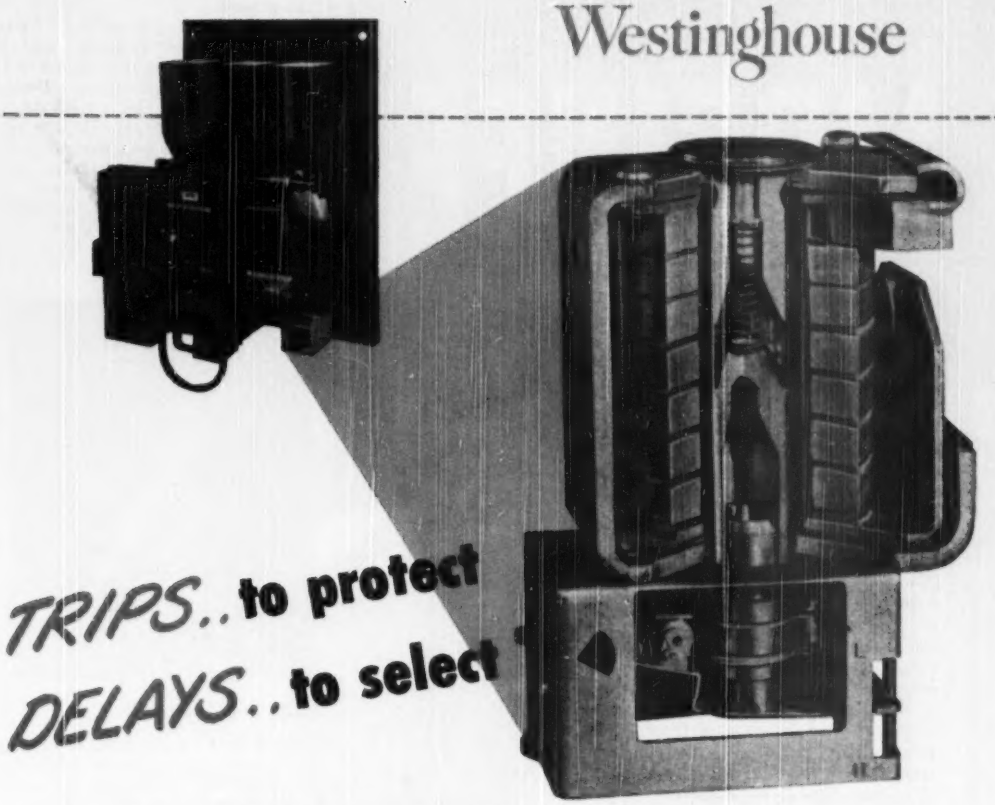
PURIFICATION SYSTEM
Oil purification can be carried out with transformer in service

ELECTRIC FURNACE
Tap-changing transformer provides 1,700 to 2,600 F range

LUMINAIRE WITH SPOTLIGHT
Fluorescent luminaire has companion swiveling spotlight

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



TRIPS.. to protect

DELAYS.. to select

the NEW DB Breaker Tripping Device

Here's a new overcurrent device that trips instantaneously on fault currents reaching a predetermined value . . . yet delays tripping on overcurrent caused by motor starting or other overloads of short duration. Also available—selective operation that causes only the breaker nearest a fault to trip. Breakers nearer the power source keep current flowing in unfaulted parts of the circuit.

This tripping device is the "mainspring" for the new Westinghouse DB Breaker—a breaker that's smaller, more dependable, more flexible, and has a longer life. Get top breaker performance, plus "one-unit" overcurrent protection, in your low-voltage system. Install the DB.

Here's the COMPLETE Story . . .

Get answers to your questions, plus complete information from the new DB Breaker Booklet. Ask your Westinghouse representative or distributor for B-4067. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60720

Westinghouse

"DE-ION" CIRCUIT BREAKERS

New Type DB

MOSINEE

"More than Paper"

In the field of electronics and the electrical goods industry, MOSINEE is known for its *dependable uniformity*, and its scientifically controlled physical and chemical properties, such as:

Good dielectric strength . . . proper softness or stiffness . . . high tensile or tear strength . . . creped with controlled stretch or flexibility . . . specified pH for maximum-minimum acidity or alkalinity . . . accurate caliper, density, liquid repellency or absorbency.

If you have a fabricating or processing problem involving paper, a discussion with MOSINEE technicians might prove helpful. Please write Dept. EW.

MOSINEE PAPER MILLS COMPANY, MOSINEE, WIS.

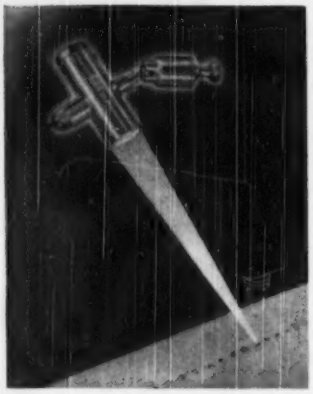
"Essential Paper Manufacturers"

either an individual transformer or three units in a 3-ph, completely self-contained bank.

Electrically, the use of Class B heat-proof materials and Quinterra is said to provide extra protection against oil, acids, alkalies, moisture, etc. Designated Type C, the line is available in 1-ph ratings of 480/240—120/240, up to 15 kva, as well as 3-ph ratings of 240 or 480 v on the primary and 120/208Y, 4-wire, on the secondary.

Marcus Transformer Co, Inc, 32-34 Montgomery St, Hillside 5, N.J.

•



Locating Spotlight

POSITIONING large assemblies on resistance welders, automatic riveters, punch and drill presses, and other production equipment is reportedly facilitated by a spotlight which locates work on blind operations. It is positioned on a ball and socket joint and the spot of light adjusted to as small as $\frac{1}{8}$ in. diam. Chrome plated, the lamp has a lens that permits definition of the spot in a wide range of diameters. It can be equipped with a transformer of 110 or 220-v secondary. Additional information is in Bulletin 203-A.

Sciaky Bros, Inc, 4915 W. 67th St, Chicago, Ill.

•

Transformer Housing

SEMI-BURIED HOUSINGS for standard overhead-type distribution transformers rated up to 50 kva extend only 35 in. above ground level.

The housing consists of two sections, a steel form being used to cast the lower section in concrete at the job. The upper section is a Bonderized and painted steel shell (weight approximately 100 lb) fitted with lugs to engage a ledge on the concrete shell. All connections to the transformer can reportedly be made before the upper section is in place. Ventilation is

for Safety, Surety and Savings

...OPERATE DISTANT VALVES

by LIMITORQUE REMOTE CONTROL

The important safety factor afforded by *LimiTorque Remote Control* cannot be overstressed, because men do *not* have to go to high, low, dangerous or inaccessible locations to open and close valves. Further, *LimiTorque* prevents damage to seats, discs, stems, etc., because it *"automatically" shuts-off the power,* should an obstruction in closing occur.

Think of the savings effected in time and money by eliminating men going from one valve to another (many of which are at distant locations)—not to mention the time required to shut or open each valve. *LimiTorque Remote Control* not only prevents this waste, but enables one man to merely *"push buttons"* and actually see on a panelboard whether the valves are open or closed.

Various *LimiTorques* are available for different requirements on all types of valves (globe, gate, butterfly, plug, etc.)—and, too, *LimiTorques* may be supplied for actuation by any power source, such as electricity, steam, water, gas, oil or air.

Thousands of *LimiTorques* are in use throughout the world, on land and sea. Be convinced; send for our 96-page catalog, L-48, and please use your Business Letterhead when requesting it.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

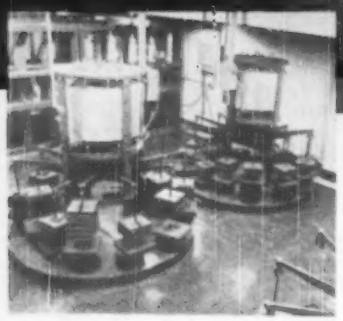
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON

IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

measuring steam- in millionths of

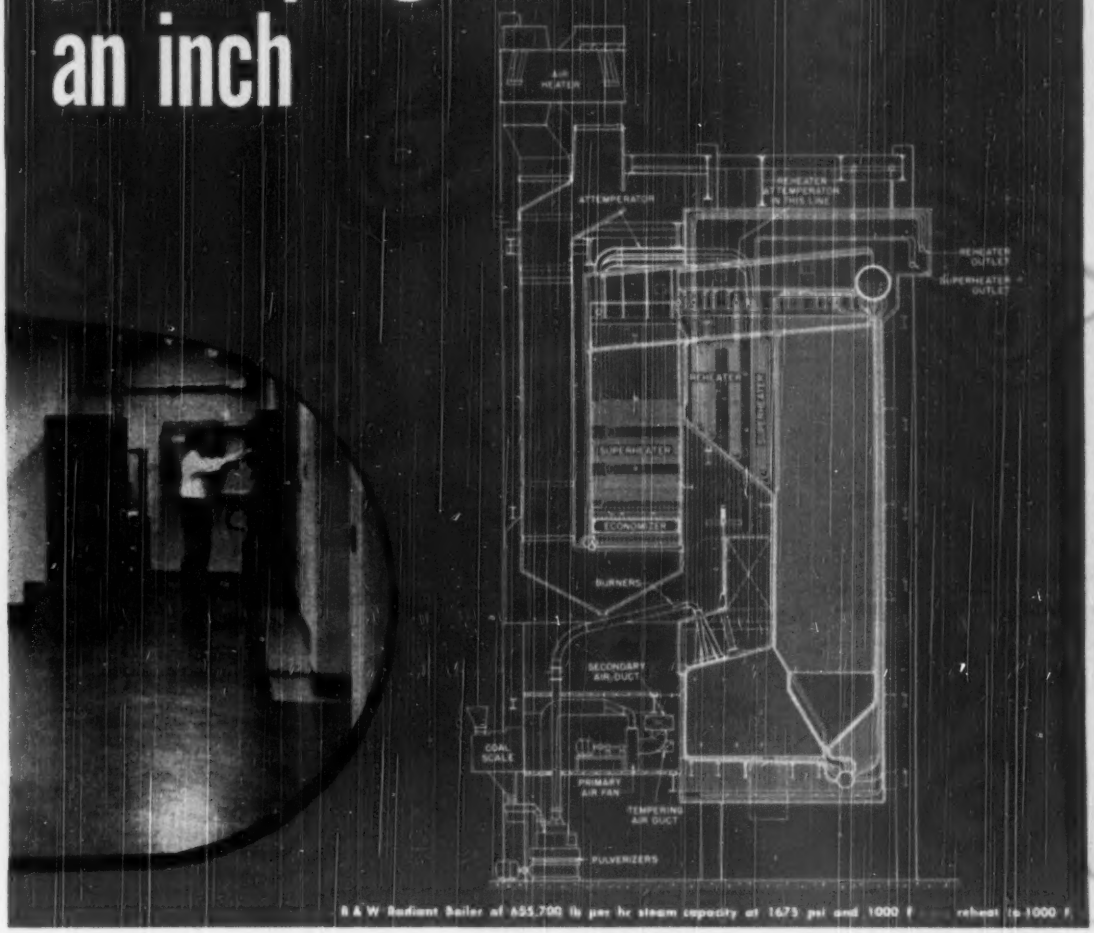
Another Example of B&W Research for Savings



Indicative of the prodigious exploration and development work behind every technological advance in steam-electric generating practice are these scenes from B&W's new laboratory at Alliance, Ohio. Here, in one of the largest research laboratories of its kind, are conducted tests on the "creep" (plastic flow) and stress-rupture of metals. So precisely uniform are these testing units that temperatures are held to plus or minus one degree F at 1550 F; so accurate that specimen elongations are measured in millionths of an inch.

From such studies in steel come those savings in steam with which B&W Boilers and component equipment have been asso-

power progress an inch



B & W Radiant Boiler of 655,700 lb per hr steam capacity at 1675 psi and 1000 F ... reheat to 1000 F

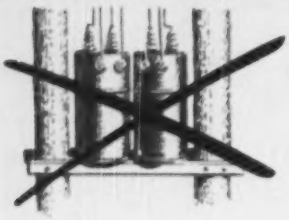
ciated for more than 80 years. For these data on the behavior of metals under a wide variety of pressure-temperature conditions, along with investigations of fuel burning methods, heat recovery, and boiler design, are indispensable pre-requisites to the modern high-temperature, high-pressure boiler, typified by the drawing shown above.

In the future, as in the past, B&W's great research organization will continue to contribute importantly to any project involving cheaper, more dependable power generation—will spend still more in helping you . . . and the power-consuming American public . . . to *save*.

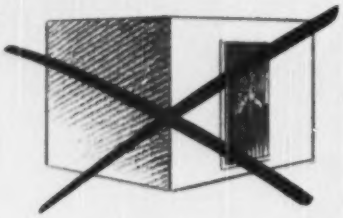
BABCOCK & WILCOX

G-4197

NO OUTDOOR PLATFORMS



NO EXPENSIVE VAULTS



when you install a

HEVI DUTY DRY TYPE TRANSFORMER

Smart utility engineers reduced installation costs by placing this Hevi Duty 225 KVA 4160-240 Volt type 31FH transformer in unused storage space of a customer's office building.

Save on Installation and Maintenance Costs!

Hevi Duty Dry Type Transformers are available in a wide range of sizes and types from ¼ to 1000 KVA with primary ratings to 15000 Volts.

Conservative design, vacuum pressure impregnation, and precise testing assure long and economical service. Write for bulletin HD 499.

HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY

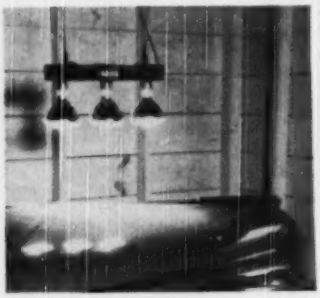
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

MILWAUKEE 1, WISCONSIN

through the space between the concrete section and the overhanging upper shell and through openings around the top of the steel housing. These openings are provided with baffles to prevent insertion of foreign material.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

•



Engine Hood Heater

THREE STANDARD INFRARED LAMPS fitted into a special channel form a garage heater. In use, the heater is suspended by chains from garage rafters with the lamps (said to be nonharmful to the paint) 10 to 12 in. above the hood surface. Mounting chains, six feet of rubber cord, and three infrared lamps rated at 2,500 hr are furnished with the unit.

Wagner-Green Co. 1935 Euclid Ave, Cleveland 15, Ohio

MORE NEW PRODUCTS about which you should know

INTERNATIONAL RECTIFIER CORP, 6809 S. VICTORIA AVE, LOS ANGELES 43, CALIF., has developed a new hermetically sealed selenium **photoelectric cell** said to have an average current sensitivity of 600 microamp at 100 ft-c illumination and 100-ohm external resistance. Of the self-generating type, the cells can be used for controlling street lights, air field lighting, smoke detectors, etc. . . . ARMA CORP, 254 36TH ST, BROOKLYN 32, N. Y., has a series of 8 400-c electrical **resolvers** for instrumentation involving trigonometric problems.

CRESCENT TOOL CO, JAMESTOWN, N. Y., is offering a new lineman's round nose **plier**, No. 2150, 8 in. . . . THE LOUIS ALLIS CO, MILWAUKEE 7, WIS., has a new ball bearing **loom motor** in ratings of ¾ to 2 hp.

WESTINGHOUSE ELECTRIC CORP, BOX 2099, PITTSBURGH 30, PA., has intro-

Nicopress

The Tool and the Sleeve

that are made to work together

together they make the perfect splice

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

Nicopress is the Registered Trade Mark of The National Telephone Supply Company

duced a line of Oil-Tite **control stations** and units designed for machine tool control and other heavy-duty installations. . . . KEYSTONE MFG CO, 23328 SHERWOOD RD, CENTER LINE, MICH., is making a **reducing bushing** that permits branching off from main wireway and power line to smaller outlets (6 to 4-in. reduction).

ZENITH ELECTRIC CO, 152 W. WALTON ST, CHICAGO 10, ILL., is manufacturing the Model RT **impulse timer** to provide impulse circuits for production line control, on-off circuits for exhaust fans, elevator starting, lab testing. Settings range from 1.5-60 (minimum to maximum) to 9-360 sec. . . . GEDNEY ELECTRIC CO, RKO BLDG, RADIO CITY, NEW YORK 20, N. Y., has offset **conduit nipples** for installation where box knockouts do not line up; sizes are from ½ in. to 2 in.

GENERAL SCIENTIFIC EQUIPMENT CO, 2700 W. HUNTINGDON ST, PHILADELPHIA 32, PA., has a battery **cell tester**, No. 17, for indicating the condition of 6-v battery cells in trucks and cars; scale markings are "dead," "discharged," and "charged" . . . W. C. DILLON & CO, INC, 5410 W. HARRISON ST, CHICAGO 44, ILL., has announced a traction type **dynamometer** for checking tension in cables or ropes, draw-bar pull, and static loads; 30,000, 40,000 and 50,000-lb capacities.

GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., has a portable radiation **detector**, the long-probe Gamma Survey Meter; can be used for monitoring areas or other types of radiation metering. . . . NATIONAL TOOL CO, 11200 MADISON AVE, CLEVELAND 2, OHIO, is marketing the Pocket Comparator, an optical **measuring instrument** for inspection of small parts or small dimensions on large parts; reportedly checks linear measurements, circles, angles, radii.

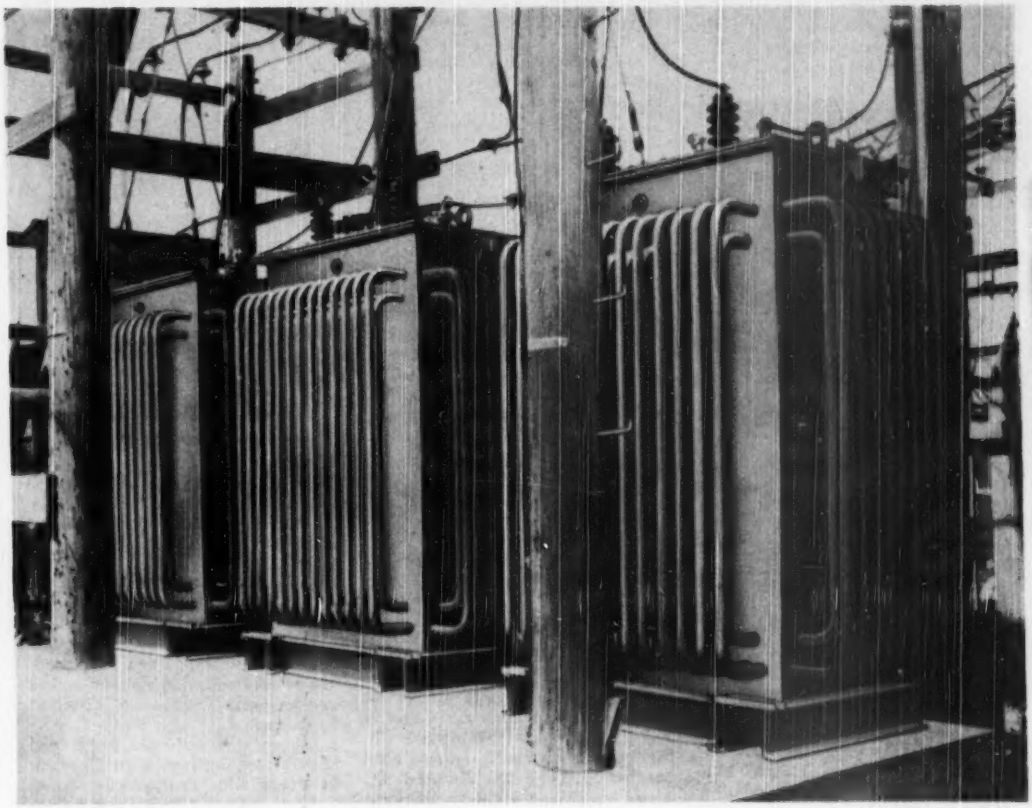
THE LINCOLN ELECTRIC CO, CLEVELAND 1, OHIO, offers the Lincwelder 60 with a special rectifier for **charging** standard 6-v lead acid auto batteries; operates from a 110-v circuit fused for 30 amp. . . . MINE SAFETY APPLIANCES CO, BRADDOCK, THOMAS & MEADE STS, PITTSBURGH 8, PA., is producing the Flash-O-Graph for spelling out **safety messages** in dots of light which move along continuously.

CENTRIC CLUTCH CO, 22-26 SOUTH AVE WEST, CRANFORD, N. J., offers a **clutch coupling** with taper bushings designed to accommodate shafts from ¾ to 1¾ in. diam, motors ranging from 0.43 hp at 580 rpm to 25.7 hp at 1,800 rpm.

LARKIN

TRANSFORMERS

ON THE JOB IN PENNSYLVANIA



3—667 KVA Oil Immersed Self Cooled Power Transformers Single Phase, 60 Cycle, Type AOP, 13,200 volts primary to 2300/400Y secondary.

MANUFACTURED BY

LARKIN LECTRO PRODUCTS CORPORATION

PINE BLUFF • ARKANSAS

Sales Offices in Principal Cities

NEWS ABOUT PEOPLE

Ebasco Services Elects Seal as Vice-President

T. G. Seal has been elected a vice-president of Ebasco Services, Inc. He is a director and general consultant for

T. G. SEAL

the Middle South Utilities group of client companies, including Arkansas Power & Light Co, Louisiana Power & Light Co, Mississippi Power & Light Co, and New Orleans Public Service, Inc.

Seal began his utility career in 1918 with the municipal plant at Marshfield, Mo. He worked for American Appraisal Co, Virginia Western Power Co, and General Engineering & Management Co before joining Arkansas Missouri Power Co as chief engineer. Later he became assistant vice-president of Arkansas Missouri. From 1934 to 1937 he was with the Arkansas Department of Public Utilities as rate engineer and later commissioner.

Seal was made director of rates and research for Louisiana Power & Light in 1937. Three years later he joined Ebasco as an assistant operating sponsor and became successively operating consultant, operating sponsor, and general consultant.

•

H. E. Bussey, engineering consultant for General Electric Co in Atlanta, has retired after 45 years with the company. He pioneered the specialized applications of electric drive in the textile industry and organized the engineering field force for GE's part in the atomic project at Oak Ridge. Bussey has served GE as field engineer, assistant district engineer, district engineer, and engineering consultant. He is a fellow, life member, and past vice-president of the American Institute of Electrical Engineers and a member of the Georgia Engineering Society.

•

MacLafferty, Oglee Are Trumbull Vice-Presidents

Two new vice-presidents have been elected by Trumbull Electric Manufacturing Co, Plainville, Conn., an affiliate of General Electric Co. Taylor D. MacLafferty has been named vice-president in charge of marketing and Frank M. Oglee, vice-president in charge of employee and community relations.

After completing GE's engineering test course and taking commercial sales training MacLafferty was made a sales representative. He worked out of the Minneapolis, Chicago, and Detroit offices of the company. In 1937 he was transferred to Carboloy Co, another GE affiliate, and in 1939 was appointed district sales manager with headquarters in Newark. He was made sales manager of Trumbull in 1947 and manager of marketing in 1948.

Oglee joined Trumbull more than 20 years ago as a sales representative, first for the Chicago district and four years later for the Philadelphia district. In 1936 he was made district manager in Philadelphia and in 1945 Atlantic district sales manager. He became manager of sales for the Norwood, O., Works in 1945 and a year later was transferred to the main works as product manager in charge of switch and circuit breaker sales.

•

William J. Crowley, Public Service Co of Northern Illinois statistician, has been appointed to the newly created position of manager of operation and economic research. He will continue to have general direction of the statistical department but also will cover the broader field of research into problems affecting the company's operations and economics. **C. C. VanDenburgh** will succeed Crowley as statistician, and **W. O. Peterson** has been named assistant statistician.

Horelick, Zimsky Given Penn Transformer Posts

Arnold L. Horelick, who has been with Pennsylvania Transformer Co since 1938, has been appointed engi-

ARNOLD L. HORELICK

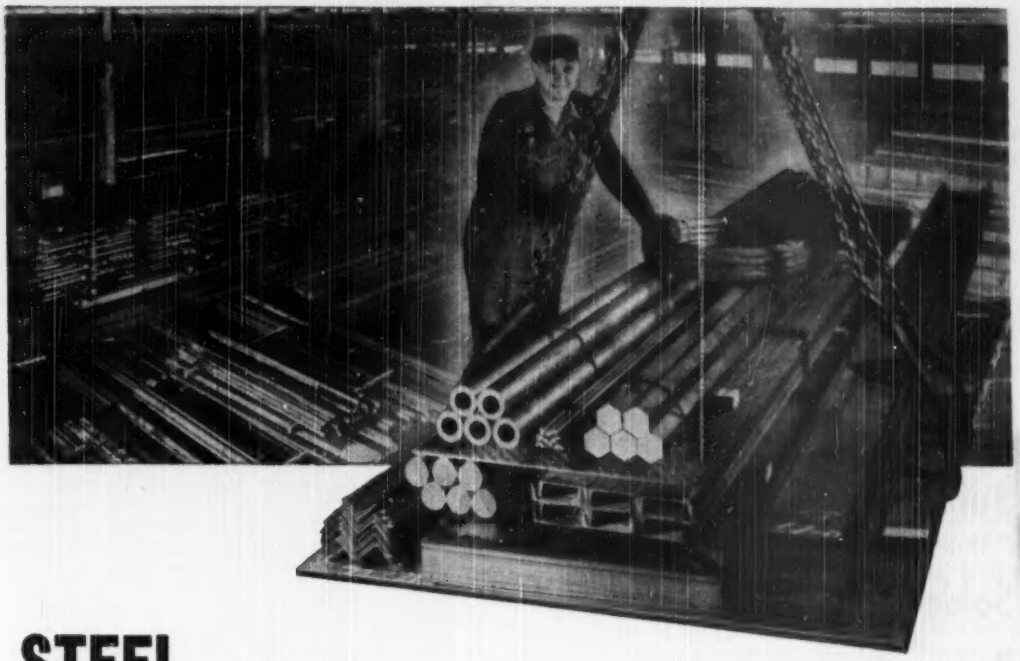
neering manager. New chief mechanical engineer for the firm is John J. Zimsky.

Horelick has done mechanical and electrical designing and sales engineering for Pennsylvania Transformer and has been assistant to the president. He is a member of the National Electrical Manufacturers Association, joint Edison Electric Institute-NEMA committees for standardization of transformers and related equipment, and of the American Institute of Electrical Engineers.

Zimsky, in transformer design and manufacture for more than 25 years, has been with Pennsylvania Transformer since 1929. Before that he was employed by the former Pittsburgh Transformer Co. Until 1941 Zimsky headed Pennsylvania's drafting department. During the war he was in charge of the special products division, which handled war contracts. Most recently he has been planning engineer. A registered professional engineer, he is a member of AIEE and the Pennsylvania Society of Professional Engineers.

•

Frederic P. Fischer, associate professor of electrical engineering at the University of Connecticut, has been appointed professor and head of the Department of Electrical Engineering at the University of Buffalo. A member of the



STEEL . . .

for Every Utility Need

Shipped Quickly from Ryerson Stocks

Call Ryerson for the steel you need and you'll find we're always on the job.

Everyday, electric power and light companies from coast to coast are being expertly served by the network of thirteen great Ryerson plants. Each plant has large and diversified stocks. Each plant is equipped to accurately cut or otherwise prepare your steel to exact specifications.

Under the Ryerson simplified purchasing system you save time. One order and one invoice quickly cover a whole group of steel requirements. Specialists, whose recommendations are backed by more than a century of Ryerson steel-service experience, will gladly assist you on any problem of application or fabrication.

For highest quality carbon, stainless, or alloy steels—any kind, shape, or size—contact your nearest Ryerson Plant.

PRINCIPAL PRODUCTS

BARS—Carbon & alloy, hot rolled & cold finished.
SHAFTING — Cold fin., ground & polished, etc.
STRUCTURALS—Channels, angles, beams, etc.
TUBING — Seamless & welded mechanical & boiler.
STAINLESS—Allegheny plates, sheets, bars, tubing.
PLATES — Sheared & U. M., Inland 4-Way Floor Plate.
SHEETS—Hot & cold rolled many types.
MACHINERY & TOOLS —For metal fabrication.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • DETROIT • CINCINNATI
CLEVELAND • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

SORGEL AIR-COOLED TRANSFORMERS

Reduce Costs

Easy to install Wall or floor mounting. No extra brackets needed.

Built-in connection compartment with convenient knock-outs.

Solderless terminals No soldering, no taping, no splicing.

Reduce feeder sizes with high voltage distribution and air-cooled transformers at load centers.

100 Kv-a. Single Phase. Floor Mounting Type.

½ Kv-a. Single Phase. 460/230 to 115 volt.

15 Kv-a. 3-phase. Wall mounting type. Showing connection compartment with solderless terminals.

Sizes ¼ to 2000 Kv-a. All voltages, 115 to 15,000 volts

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 834 W. National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled transformers

Institute of Radio Engineers, he has taught at Massachusetts Institute of Technology, Rutgers University, and Lehigh University. He joined the Connecticut faculty in 1944.

•

Burke Heads Lighting Division of Westinghouse

Burt S. Burke, manager of Westinghouse Electric Corp's switchgear distribution apparatus department at East Pittsburgh, Pa., since 1948, has been appointed manager of the Lighting Division at Cleveland.

S. F. Davies, Jr. has been named manager of the Division's commercial, industrial, and floodlighting section. Other recent Westinghouse appointments include **John W. Simpson** as assistant engineering manager for the Atomic Power Division, Pittsburgh, and **Glenn A. Caldwell** as engineering supervisor of the Detroit engineering and service department, with headquarters in Detroit.

Burke, who has been with the company 27 years, was assigned to the Switchgear Division in 1924. While with the firm's New York service department he designed and directed installation of the stage switchboard at Radio City's Center Theater. Later he served as switchgear specialist for the Southwestern District and as switchgear supervisor for the Northwestern District.

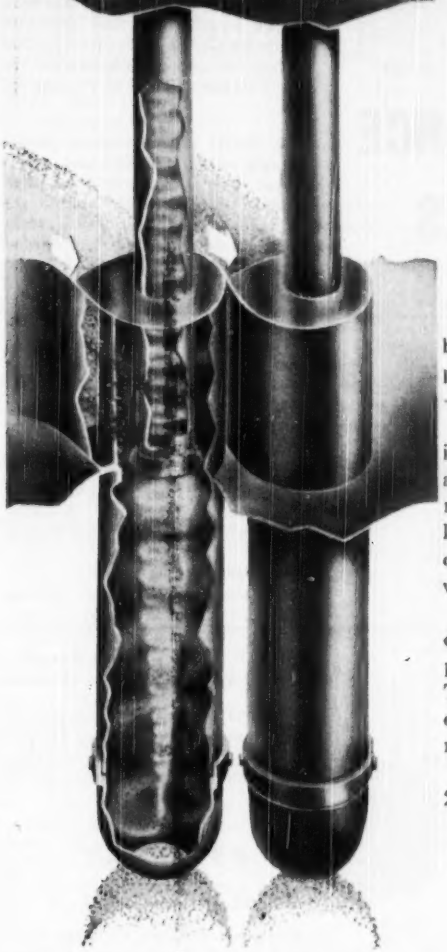
During the war Burke was with the War Production Board's Office of War Utilities and then with the Manhattan District Project. In 1946 he returned to East Pittsburgh as assistant sales manager for the Switchgear Division. Later he served as assistant to the Division manager.

Davies, who joined the company in 1940, was made manager of the ballast and special products section in 1948. Simpson started with Westinghouse in 1937 in the Switchgear and Control Division. Since 1948 he has been supervising engineer on low-voltage air circuit breakers. Caldwell, with the company since 1927, has been manager of industrial control engineering for the past three years.

•

Aaron N. Simmons, electrical engineer of power plants of Detroit Edison Co. has retired after 47 years with the company. His normal retirement was postponed so that he could coordinate the installation of electrical equipment for the new high-pressure section of the Trenton Channel Plant. Simmons first became associated with the Trenton Channel Plant as plant electrician in 1924. There he helped develop an elec-

THE INLET THAT *Boosted* COLLECTION *Efficiency*



Exclusive in the
VALMONT TYPE S DUST COLLECTOR

High collection efficiency in the ultra-fine dust range below 20 microns was the goal attained by Prat-Daniel Corporation with the introduction of the Valmont Cyclonic Tube—the tube with a high, narrow inlet.

The advantage of this patented inlet proportion design is that it reduces the radial distance of travel of dust particles as they spiral downward. Ultra-fine particles, entering the high, narrow inlet of the Valmont Type S Tube near the center, have less distance to travel to the tube wall and a greater percentage of them will reach that wall before the downward spiral is ended, without excessive tangential velocities normally required.

As dust codes become more stringent, the high mechanical collection efficiency of the Valmont Type S becomes more important. Due to a series of design improvements, the Valmont Type S Tube offers improved aerodynamic flow, increased capacity per tube with resulting decrease in space requirements, weight and price.

Valmont Type S Tubes are shipped in "uniblocs" of 15, 20 or 25 tubes each, materially reducing erection costs.

Project and Sales Engineers

THE THERMIX CORPORATION

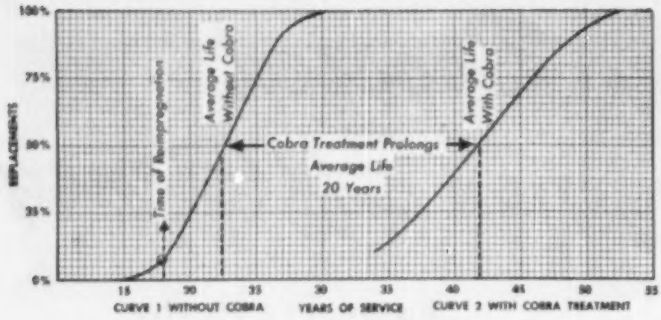
GREENWICH, CONN.

Canadian Affiliates:
T. C. CHOWN, LTD., 1440 St. Catherine St. W., Montreal 25, Quebec

PRAT-DANIEL CORPORATION

75-2 WATER STREET — EAST PORT CHESTER, CONN.

DESIGNERS AND MANUFACTURERS OF POWER PLANT EQUIPMENT FOR OVER 25 YEARS



Preventative MAINTENANCE *for* WOOD POLE LINES

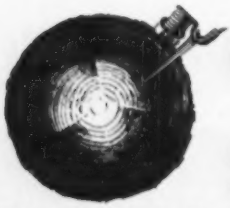
Today a pole replacement costs more than $100. If a pole goes down the cost is greater, the lost revenue an important item. Probably eighty percent of your poles will last another twenty years if treated by Cobra now. Cobra inspection service will survey the entire line and report on which poles should be replaced before they fall down.

Inspection costs less than a dollar a pole. Cobra treatment, including excavation and refill, costs less than ten dollars per pole. All on one contract—nothing for your line crews to do.

These economic facts are proven by service records of more than two million poles and by numerous laboratory tests available on request.

Cobra is not an external application but a deep injection of a combination of water soluble salts which continue to diffuse long after the treatment.

COBRA SERVICE DOUBLES THE USEFUL LIFE OF YOUR POLE LINES AND SHOWS ENORMOUS FINANCIAL SAVINGS AT A TOTAL COST LESS THAN THREE TO FOUR YEARS AVERAGE ANNUAL REPLACEMENTS. ECONOMIC SURVEY AND COMPLETE TECHNICAL DATA WILL BE SENT ON REQUEST.



COBRA
WOOD-POLE
SERVICE

COBRA WOOD TREATMENT CORPORATION
124 EAST 40TH STREET • NEW YORK 16, N. Y.

trostatic fine dust collector, one of the first such installations in this country. He is a member of the American Institute of Electrical Engineers.

Malcolm Lund has been appointed advertising and sales promotion manager of the home appliance division of The Murray Corp of America, with headquarters in Scranton, Pa. Formerly an account executive with Young & Rubicam, Inc, Chicago, Lund also has been director of advertising and sales promotion for United Wallpaper, Inc, and national war campaigns manager of the War Production Board in Washington, D. C.

C. E. McGee has been named general manager of the utilities department of Etowah, Tenn. He formerly was Commissioner of Public Works and Finance and Taxation with the City of Lebanon and at one time was with the TVA and the Alcorn County Electrical Power Association.

Charles H. Wagner has been appointed resident engineer for construction at Chief Joseph Dam on the Columbia River in Oregon. Wagner was resident engineer for construction of the Harlan County Dam at Republican City, Neb. He has been with the Corps of Engineers since 1925. Last September he was transferred to the Seattle district as assistant to Raymond F. Bracelin, in charge of designing Chief Joseph.

R. C. Piper, Jr. has been appointed sales manager of La Salle Lighting Products, Inc, Buffalo, N. Y. He formerly was in the merchandising departments of R. H. Macy Co and Montgomery Ward & Co for more than 10 years.

Thomas Clevenger, chief engineer of the Southeastern Illinois Rural Electric Cooperative since 1945, has been appointed manager, succeeding **A. F. Lentz.**

OBITUARY

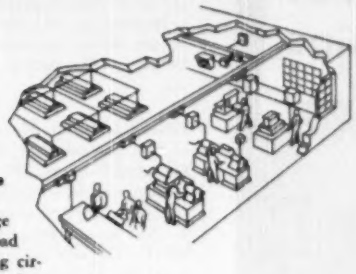
Frederic N. Bushnell

Frederic N. Bushnell, 82, former vice-president and vice-chairman of Stone & Webster Engineering Corp, died at Brooklyn, Mass., Jan. 23.

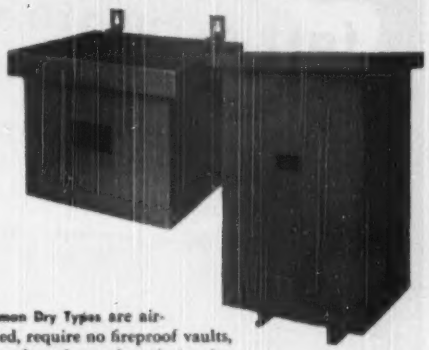
Bushnell began his career with the Providence (R.I.) Engineering Works, where he became chief engineer. Later he was chief engineer of Narragansett Electric Lighting Co, Providence, and of local transit and steamship companies.

He was named engineering manager of Stone & Webster in 1909 and vice-president in 1912. He retired in 1947 after contributing to high-pressure

How KUHLMAN puts power where you need it



Kuhlman Dry Type Transformers deliver high voltage right to your load centers. Lighting circuits, machine tools, and other electrical equipment are most efficiently served by locating transformers near at hand. This eliminates costly long runs of heavy copper, reduces operation losses and improves voltage regulation.

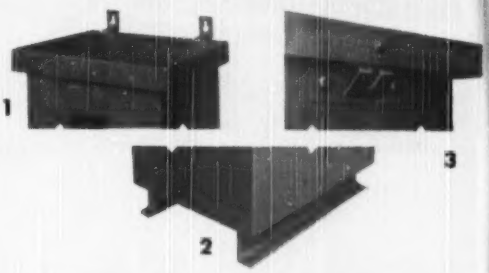


Kuhlman Dry Types are air-cooled, require no fireproof vaults, and reduce fire and explosion hazard to a minimum. Available in either wall or floor mounted units, 1 through 300 KVA, single phase and 3 through 1500 KVA, three phase.

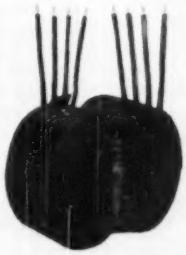
Easy installation, easy handling! Kuhlman Dry Type Transformers are equipped with convenient wall mounting brackets for bolting to wall or beam.

Floor mounted types come equipped with drilled channels for easy bolting to floor or platform surface.

Easy handling is assured by handy lifting lugs that make moving of Kuhlman Dry Types a simple matter.



Less weight, better performance are assured with the Kuhlman Bent Iron Core. Used in single phase units 25 KVA and below, the Bent Iron Core is made of high grade oriented cold rolled steel. This steel provides greater flux carrying capacity, resulting in a lighter core, lower exciting current and impedance, better regulation and performance. This all means a smaller, lighter, more efficient transformer for you.



A few turns of a wrench removes the louver panel or cover for quick accessibility to roomy terminal compartment. Handy conduit knockouts make the connection job an easy one. Result — few installation and maintenance worries when you buy Kuhlman dry types.

Get further information on Kuhlman Dry Type Transformers. Write for Bulletin CS 701 just off the press. Kuhlman also manufactures a complete line of Power, Distribution, Street Lighting, and Specialty Transformers. Bulletins available upon request.

EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

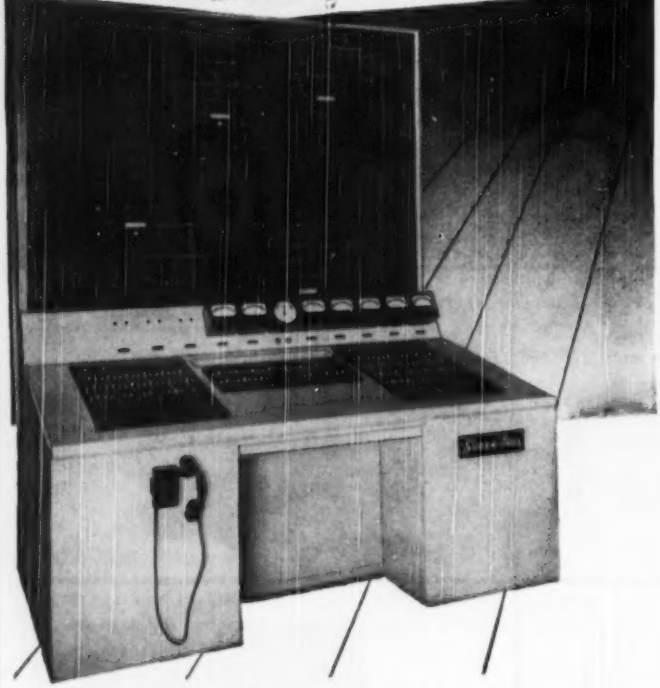
Kuhlman

KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN

Export Representatives: *International Standard Electric Corporation*, 67 Broad St., New York City, N.Y. Cable Address: Microphone, N.Y.

fast accurate control at your fingertips with SUPER-TROL

THE MODERN METHOD OF SUPERVISORY CONTROL



SUPER-TROL is today's answer to remote and continuous equipment control requirements in sub-stations . . . hydro-plants . . . pumping stations . . . and the numerous other places needing remote control.

PROVIDES FAST FINGERTIP CONTROL

Throwing a switch and pushing a button starts a generator . . . closes or opens a breaker . . . cuts out a transformer . . . meters voltage, current, or power at any point. SUPER-TROL is fast, positive, accurate, dependable.

TELLS OPERATION OF EQUIPMENT

SUPER-TROL tells at a glance the condition of all equipment. Gives fast indication of all automatic operations. Uses a single pair of wires or carrier current channel for any and all operations. Can operate simultaneously with telephone conversations.

NEW MAP BOARD SHOWS LOCATIONS

A visual aid showing location as well as operation of equipment. Very valuable in an emergency.

WRITE FOR DETAILS about SUPER-TROL.

It can help you solve your present and future supervisory control problems.

TROL CORPORATION

719 CENTRAL AVE. • MINNEAPOLIS 14, MINN.

steam plant development and nation-wide engineering undertakings. The annual award of the Engineering Societies of New England was presented to Bushnell in 1945. He also received a 50-year service pin from the American Society of Mechanical Engineers.

•

Edward J. Brown, 50, former president of the International Brotherhood of Electrical Workers, AFL, died Jan 31 in Washington, D. C., following a kidney operation. Brown went to Milwaukee in 1930 as a special representative of IBEW. He was business manager of Local 469 in Milwaukee until his election as president in 1940. After his defeat for re-election in 1946 he was an attorney in Wisconsin and in Washington. A member of the National Defense Mediation Board, Brown was said to be one of four top labor men to whom the atomic bomb project was disclosed in December, 1944. He also had been regent of the University of Wisconsin and a member of the International Policy Committee of the National Planning Association, which studied postwar loans to Europe.

F. W. MacNeil, who retired in 1947 as executive manager of the heavy apparatus division of Canadian General Electric Co, Ltd, at Vancouver, B. C., died there recently. He started with the company in Toronto in 1908 and went to Vancouver as executive manager in 1917.

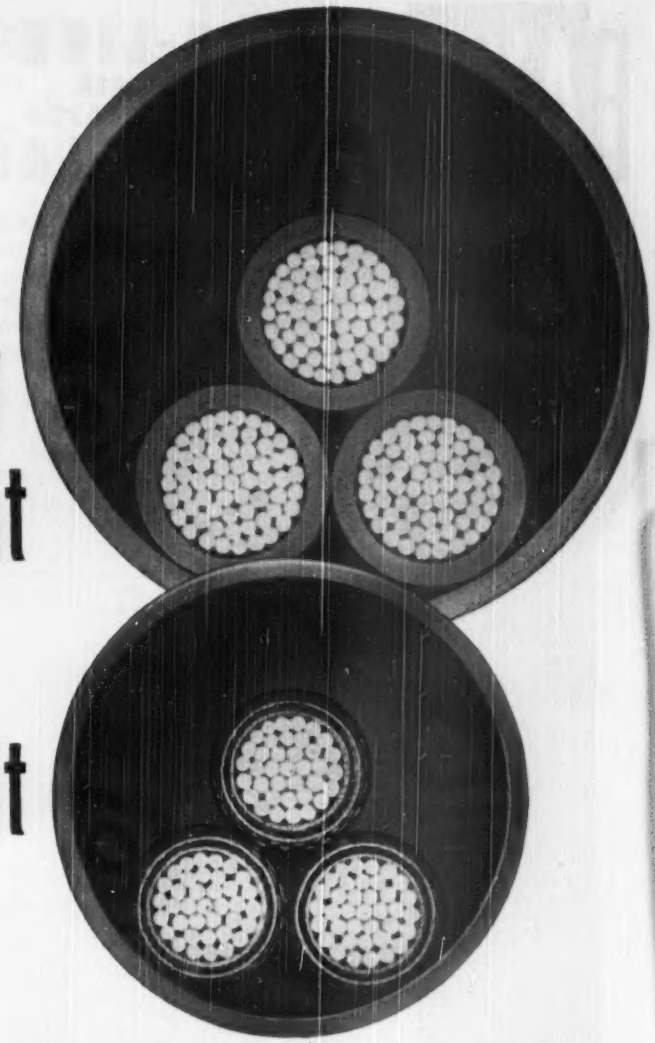
Alden C. Goodnow, 61, former sales manager at the Pittsfield (Mass.) Works of General Electric Co, died at Danvers, Mass., Jan 31. He entered the company's service in 1911.

Paul M. Lee, 59, a member of the engineering department of Niagara Mohawk Power Corp, died in Syracuse, N. Y., Jan 25. He was an engineer in charge of special studies for the system, with which he had been associated since 1930. Lee at one time was purchasing agent for St. Lawrence County Utilities, Inc.

John W. McGaughey, 73, chairman of the board of Canton (N. Y.) Electric Light & Power Co since 1948, died Jan 25 at his home in Canton after a long illness. He became secretary of the utility in 1914 and president in 1929.

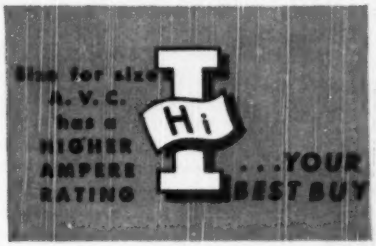
John J. Ryan, 63, who had been associated with Consolidated Edison Co of New York for 50 years, died suddenly Jan 29. Starting as a lamp boy, he became assistant general superintendent in the Bronx and general superintendent of the system's meter activities. He retired three years ago.

Why Buy 4" Conduit when 3" Conduit will do?



INSTALLED COSTS ARE LOWER

with high-rated ROCKBESTOS A.V.C.® and a 430 Ampere Load*



- you buy 25% *smaller* conduit
- you use 38% *smaller* cable
- you use *smaller* fittings and lugs
- you have lower labor costs because smaller, lighter cable and conduit are quicker and easier to handle.

To save money specify *permanently-insulated* Rockbestos A.V.C. Write for the booklet "The Story of An Insulation."

*Comparison made with Type RH based on Chapter X, National Electrical Code, 40°C-104°F Ambient

ROCKBESTOS A.V.C.

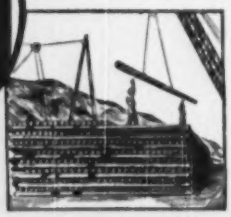
ROCKBESTOS PRODUCTS CORPORATION, NEW HAVEN 4, CONN.

NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

BAXCO

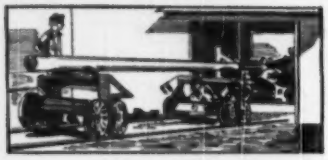
LONG-LIFE
DOUGLAS FIR PRESSURE TREATED
LONG POLES

For over 50 years J. H. Baxter & Co. with its Associated Pacific Coast Companies has specialized in the production and sale of exceptionally long (up to 125 feet) Wood Poles for the electric power, lighting and telephone utilities . . . Stocks in all lengths are complete — shipments prompt!



PROPER SEASONING

BAXCO poles are carefully seasoned in dry, clean yards. Proper pre-conditioning before Pressure Treatment adds years of longer life.

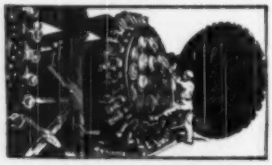


MACHINE SHAVING

To produce smoother and more uniform poles, the BAXCO process includes machine shaving. This removes small swells and results in a more round, evenly tapered product.

PRESSURE TREATMENT

Deep penetration and high retention of the preservative is a hallmark of the BAXCO Pressure Treatment Method.



Get the Full Story! Write today for this BAXCO BOOKLET

J. H. Baxter & Co.

330 MONTGOMERY STREET SAN FRANCISCO 4, CALIFORNIA

ASSOCIATED COMPANY: J. H. BAXTER & CO., OF OREGON

AIEE SESSIONS

(Continued from page 85)

CHEMICAL, ELECTROCHEMICAL AND ELECTROTHERMAL APPLICATIONS

Cable Insulation for Chemical Plants. F. S. Glaza, *Dow Chemical Co.*

Installations of various types cables were discussed after 10 years operation in chemical plant located about one mile from salt water. Cable Insulation for Chemical Plants. J. H. McCullough, Union Carbide and Carbon Corp.

Eight major interruptions due to cable failure during nine years operation were analyzed.

Cable Insulation for Chemical Plants. C. S. Latham, A. A. Jones, L. L. Carter, *Anaconda Wire & Cable Co.*

Polyvinylchloride-insulated conductors are being used in ever increasing quantities in severe industrial and chemical plants up to 600 v.

Cable Insulation for Chemical Plants. R. B. McKinley, B. J. Mulvey, *General Electric Co.*

Polyethlene shows great promise with respect to its electrical behavior in kerosene but its use has been limited by its lack of flame resistance, low melting point and splicing difficulties.

Cable Insulation for Chemical Plants. R. C. Graham, *Rome Cable Corp.*

Suggests sale practice for chemical plant wiring with recommended types for various locations, voltages ac and dc and for special conditions present.

Cable Insulations for Chemical Plants. E. W. Davis, *Simplex Wire and Cable Co.*

Development of rubber compounding technique, synthetic rubbers, and thermosetting materials have permitted design of new and improved cables by cable industry.

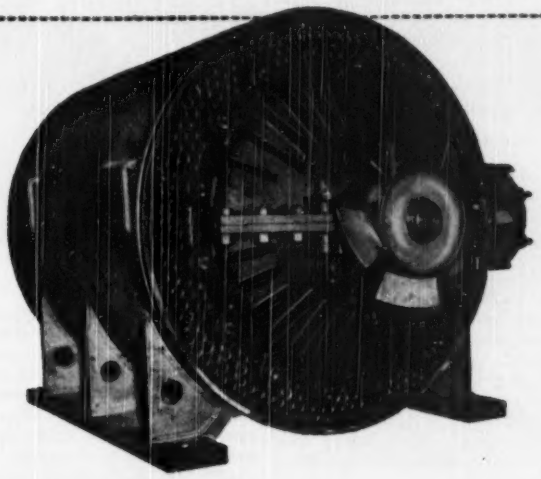
E. J. Merrell, Phelps Dodge, said about polyethlene that every possible use should be made of this material which has low softening point, is simple to produce, has ample margin of safety and high heat capacity, acts as heat absorber, is safe to have around under all conditions, will not crack if not strained beyond elastic limits, is self lubricating, does not cold flow, creeps slower than lead, will give no trouble if installed properly.

F. W. Acock, Roebling Co, suggested that PVC has good application in mines (within its temperature rating). For unusually abusive mine conditions—rubber cables are suggested.

L. C. Peterman, Ford, Bacon and Davis, said that oil base compounds should be given more consideration for both nominal and higher voltages. He said that neoprene sheaths are not the cure-all sometimes believed.

H. G. Burd, Ansonia Electric Co, set up a tabular comparison of the different insulations and jackets.

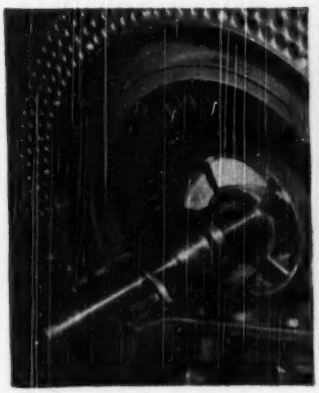
ANACONDA copper tubes in stator yoke solve explosion-proof motor design problem

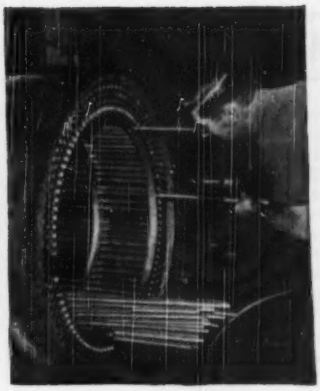


Getting rid of heat has always been a major problem in motor design. But in an explosion-proof motor that problem is really tough. The cooling system developed in the new 400-hp. 2300-volt Allis-Chalmers Explosion-Proof Tube-Cooled Motor, shown here, solved the problem neatly. It is entirely self-contained. Requires no water flow. Contains no inert gas. Just air.

Rapid, adequate heat transfer is effected by circulation of the sealed air. Cooling air is continuously forced through the copper heat transfer tubes mounted in the stator yoke. Simple, efficient, dependable.

Good ideas and the right materials can give alert manufacturers a big competitive advantage. ANACONDA Copper and Copper Alloys—and the experience of ANACONDA technicians—help solve many critical design problems in the electrical industries. May we help solve yours? Tell us about it. Your inquiry will be handled promptly, competently and confidentially by our Technical Department. Please address The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

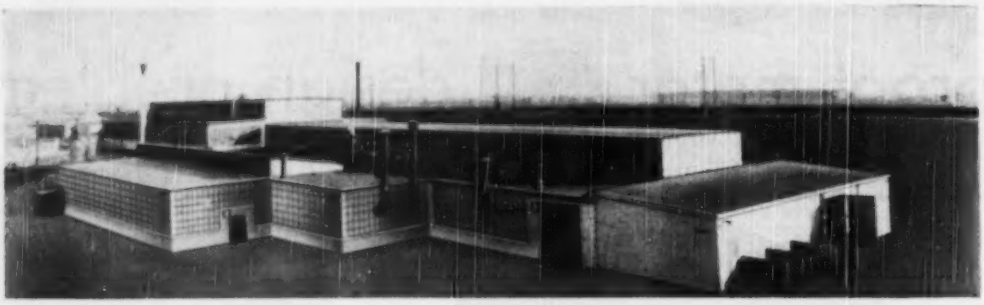




400-hp. 2300-volt explosion-proof motor designed and built by Allis-Chalmers Manufacturing Company. Internal fans on the rotor shaft circulate sealed air around the ANACONDA Copper cooling tubes shown here. At the same time, room air is forced through the tubes by an external fan mounted on one end of the rotor shaft. Thus internal heat is rapidly, effectively and safely dissipated.

For copper and its alloys . . consult **ANACONDA**

MANUFACTURERS and MARKETS



NEWARK PLANT of the American Transformer Co, where the company has consolidated all activities formerly carried on in the city

American Transformer Consolidates Operations

American Transformer Co, manufacturer of AmerTran products, has consolidated all of its operations in a plant at 285 Emmet Street, Newark 5, N. J. The consolidation was interrupted by the war, which forced the company to open additional plants wherever it could find space.

In the consolidated plant the company has capacity to produce approximately four times the volume of transformers manufactured before the war. Equipment being manufactured includes all types of transformers ranging from small components for electronic circuits to large transformers rated 10,000 kva at 169 kv.

•

GE '49 Turbine Output Equal to Record of 1948

General Electric Co's turbine production in 1949 was equal to its 1948 output, which had been the highest in the company's history. Last year the company turned out 2,797,500 kw of fuel-fired electric generating capacity for the nation's electric utilities.

Expanded manufacturing facilities will enable GE to produce more than 3 million kw of generating capacity in 1950, Glenn B. Warren, manager of the Turbine Divisions, predicted. Last year a new $30-million turbine plant, largest factory building constructed in the United States since the war, was put into service at Schenectady, N. Y.

Included in the 1949 shipments were turbine generators ranging in size from 10,000 to 150,000 kw. Two high-pressure, high-temperature 125,000-kw steam turbines and a 40,000-kw combination mercury-vapor, steam-turbine plant will generate electric power more efficiently than any type of fuel-fired equipment previously built, Warren said. GE also built and installed the nation's only mercury-unit power plant for industrial use, at its own Pittsfield, Mass., plant, and the country's first gas-turbine power plant for use in a utility generating station.

MANUFACTURING BRIEFS

Porcelain Insulator Corp. Lima, N. Y., has adopted a retirement plan guaranteeing a minimum pension of $25 a month exclusive of social security. The company will pay costs of establishing the plan and premiums for the first year. Thereafter employees will contribute 2% of their salaries annually if they earn less than $3,000 a year and 3% if they earn more than that amount. An insurance policy will provide death benefits equal to at least 100 times the amount of the monthly retirement pension.

A new 12-page catalogue on educational aids for power supplier rural youth programs has been published by the school service department of Westinghouse Electric Corp. Thirty-five Westinghouse pamphlets, booklets, and motion pictures are described. Copies can be obtained without charge from School Service, Westinghouse Electric Corp, 306 Fourth Ave, Box 1017, Pittsburgh 30, Pa.

The automatic dishwasher is gaining public acceptance more rapidly than any other major appliance since the automatic washer, but it still is a luxury item appealing chiefly to higher-income families, Hotpoint, Inc., reports. A random sampling of 10,000 questionnaires filled out by users who bought dishwashers in the 12 months ended Nov 31 showed that 60.3% of the machines sold went into homes valued at more than $15,000. The average installation cost of $66 is "too high," said Edward R. Taylor, Hotpoint sales manager, and it should take a sharp downward turn in 1950.

Seven of General Electric Co's 60 distributors sold 8,500 complete kitchens to speculative builders in a 45-day period ending late in January, I. P. Pruitt, manager of the company's Home Bureau, told a meeting of its major appliance distributors in Trenton, N. J.

This year will be a record one for commercial electric cooking, H. G. Blakeslee, chairman of the commercial cooking equipment section of the National Electrical Manufacturers Association, predicts. He estimated sales for 1949 at $16 million and said that figure undoubtedly would be surpassed in 1950.

Lincoln Electric Co, Cleveland, has established a welder parts exchange plan in order to have factory-built stators, armatures, and certain control

The

NEW LITTLEFORD

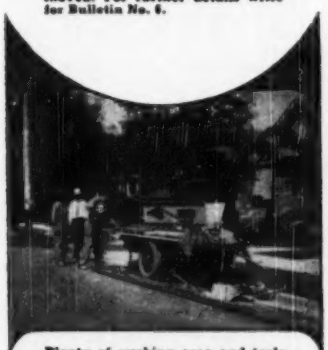
ALL STEEL

PORTABLE

"HAN DEE BOX"

The Low Cost unit for transporting valuable tools

Here's the Weatherproof, Thiefproof, Fireproof all steel HanDee-Box, the tool box constructed to trail at high speed. In addition the HanDeeBox is sturdily built, light weight and modern in appearance. The HanDeeBox too, has a patented all around locking arrangement, wide working shelves on both sides, partitions and shelves for storing tools. Gas Companies and Contractors will find this HanDee-Box the low cost method for transporting tools to the job, and leaving them overnight without fear of losing them as neither the HanDeeBox or the tools can be removed. For further details write for Bulletin No. 6.



Plenty of working area and tools are available when the Littleford HanDeeBox is on the job.

LITTLEFORD

LITTLEFORD BROS. INC.
421 E. Pearl Street, Cincinnati 2, Ohio

The man on the pole will tell you—

KLEINS

Since 1857

If you know linemen, you know they want the finest in quality when it comes to equipment. Not only does their job depend on it—many times their lives do.

It is the reputation of nearly a century in designing and manufacturing the finest in linemen's equipment that has won Klein its position of preference with linemen and electricians everywhere.

It is easy to make equipment that looks like Kleins. It takes years of experience plus extensive manufacturing facilities to make equipment that performs like Kleins.

Today you are assured prompt delivery on all Klein products. Be sure your pliers, climber straps, safety belts and other items carry the Klein trade-mark—famous for quality "since 1857."

ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp., New York

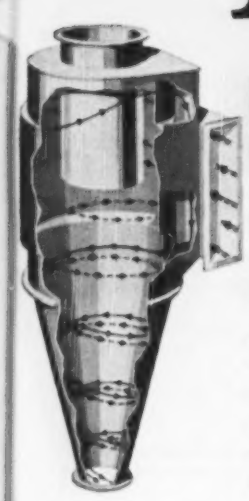
The Klein Pocket Tool Guide showing the Klein line and containing useful tool information will be mailed on request.

Mathias **KLEIN** & Sons

Established 1857 — Chicago, Ill., U.S.A.

Countless angles to be checked in facing a

Fly-ash PROBLEM



Nobody knows

a foolproof formula that can be applied to all conditions. Each job requires individual engineering analysis... *by specialists.* Buell renders such a service, with no obligation to you. If a Buell Cyclone System can logically be recommended, it will be a tailored-to-the-job installation, of pre-measured and stated % efficiency. A Buell System naturally excells any ordinary cyclone, since it has the exclusive van Tongeren patented 'Shave-Off'. We invite your general or specific inquiry, and an opportunity to put *service* ahead of salesmanship. As a starter, let us send you the 32-page book, 'Engineered Efficiency'. Write: Buell Engineering Company, 70 Pine Street, Suite 5050, New York 5, N. Y.

buell Engineered Efficiency in DUST COLLECTION

parts available all over the country for repair service. Old parts may be traded in for factory-wound ones. Standard prices in effect include a trade-in allowance, which reduces the cost for factory parts below the cost of individual local rewinding and repairing.

•

Million Electric Ranges Is Predicted 1950 Sale

This will be another million electric range year, William F. Ogden, chairman of the Electric Range Section of the National Electrical Manufacturers Association and manager of product planning for Hotpoint, Inc, says.

The industry expects to sell 1,100,000 new ranges in 1950. Going should be on a more even keel than last year, Ogden said, in a less fluctuating business atmosphere.

If electric cooking's present rate of growth continues, it will not be many years before electric ranges in use outnumber any other fuel type, he declared. But the market is still wide. If 1,100,000 new ranges are sold this year, the saturation by the end of 1950 will be about 20% of all wired homes. It is estimated that 2 million additional residences, a large proportion of them new homes and apartments, will receive electricity for the first time this year.

•

New Sales Assignments

Electrical manufacturing companies have made the following appointments to their sales staffs:

Essex Wire Corp's R-B-M Division, Fort Wayne, Ind., has named James Kress St. Louis area representative, with an office at 3435 Chouteau Ave. R-B-M also has opened a new office at 5219 Crittenden Ave, Indianapolis, with P. C. Metsker in charge. Metsker has been replaced in the Detroit office by Ed Easley.

Westinghouse Electric Corp has named C. Swan Weber manager of the Eastern district, with headquarters in New York.

William Brand & Co, New York, N. Y., has named McKenzie & Shugg, Inc, Pittsfield, Mass., as its sales representative in New England and eastern New York for its Turbo line of electrical insulating materials.

Rome (N. Y.) Cable Corp is opening an Atlanta warehouse at 156 Simpson street, N. W. The company's Atlanta district sales office, of which C. J. McMurry is in charge, also will be located at the same address.

Springfield (Ill.) Boiler Co has appointed Power Equipment Co, 4706 Holly St, Kansas City 2, Mo., as sales representatives for Springfield water tube boilers in the Missouri Valley and western plains area north of Texas, including the Rocky Mountain area and Wyoming, Montana, and North Dakota.

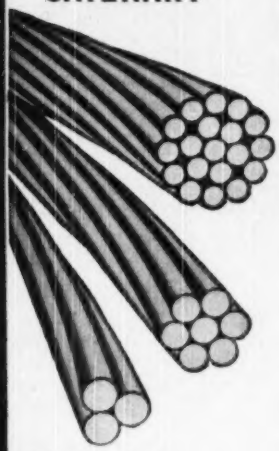
PAGE

Stainless Steel

STRAND

for

GROUND
GUY
MESSENGER
CATENARY



Higher

in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
Strength to Weight Ratio

Lower

in Cost per Year
of Installed Life

Write us for literature or answers to specific engineering questions

ACCO

Moosic, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Pittsburgh, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

In Business for Your Safety

WHEN *Time* IS THE ESSENCE

in Line Clearance

YOU'LL FIND BARTLETT READY

THAT'S one of the benefits in dealing with Bartlett . . . adequate man power, *men who are thoroughly trained,* not just picked up for a few days' work. When you deal with Bartlett, you're dealing with a company that's on the job every week, every month of the year, ready at all times to do your work when you need it, and do it the right way.

MORE and more utility companies are turning to Bartlett every year; they've found out that the plus value in every Bartlett job is just plain good business. Why not benefit, too? Call our local office in your community today.

BARTLETT SERVICE MEANS

- CLOSE SUPERVISION
- TRAINED MEN
- BEST EQUIPMENT
- CAREFUL WORK
- PROMPT SERVICE
- ECONOMY
- RESPONSIBILITY

BARTLETT

TREE EXPERTS

The Bartlett Way

HOME OFFICE: RESEARCH LABORATORIES & EXPERIMENTAL GROUNDS, STAMFORD, CONN.

LOCAL OFFICES: Rutland, Windsor, Vt.; Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Manchester, Osterville, Pittsfield, Mass.; Providence, R. I.; Danbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Peekskill, Southampton, Syracuse, Westbury, White Plains, N. Y.; Bernardsville, Morristown, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.

WHEN YOU PLAN POWER DAM PROJECTS.....

ASK US ABOUT

GATES & GATE HOISTS

BACKED BY OVER 60 YEARS EXPERIENCE

Our Engineering department is at your service, any time, to help solve problems involving this type of equipment.

Murray Gate Hoists are designed and built to meet all requirements . . . from the smallest hand operated to large motor operated—a wide range of capacities from less than 1 ton to over 100 tons. During our over half a century of designing and building gate hoists we have developed various designs for the different types of gate hoist problems. We feel sure we have designs and patterns that will fit your requirements.

We also build gate hoists entirely from your plans and specifications, if desired. In planning gates or gate hoists it is suggested you communicate with us before your plans for the project as a whole are completed . . . it will save expense and much preparation time.

MURCO

D. J. MURRAY MANUFACTURING CO. WAUSAU, WIS.

PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •

Tailored to Your Needs

● Whether you have management or operating responsibility we have a new, informative booklet that's tailored for you. It will give you valuable information on day and night protection of property and persons by means of fence that's also tailored to your requirements. Your Page Chain Link Fence can be of the style, height and metal that is best for you, no matter what the conditions. And it will be erected by experienced, local experts who offer more than a product—a complete fence service. Write for DH-142. With it we will send name and address of nearest Page Fence specialist.

Write *to* ***PAGE FENCE ASSOCIATION*** *in* ***Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, Pittsburgh, New York*** *or* ***San Francisco.***

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona—Bureau Reclamation, Dpt. Interior, Phoenix, Ariz., misc. structural steel for Tucson substation, Davis Dam Proj., Spec. R3-PX-35 (Region 3). L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Arkansas—U. S. Eng., 300 Broadway, Little Rock, powerhouse and switchyard, Bull Shoals Dam, CIVENG-03-050-50-41. Extended date.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Wilds Spur, Colo., circuit breakers disconnecting switches, grounding blades, for Flatiron Switchyard, Colorado-Big Thompson Proj., Spec. 2905. L. N. McClellan, ch. engr.

Florida—Choctawhatchee Electric Cooperative, De Funiak Springs, 159 mi. rural distr. lines and sys. imprvs., Walton Co., **$220,000.**

Georgia—Satilla Rural Electric Membership Corp., Alma, 384 mi. rural distr. lines and sys. imprvs., Bacon Co. **$900,000.**

Idaho—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., 3 motor-driver pumping units, 2,300 volt and 440 volt motor control and metering equipment for wells A, B, and C, Spec. RI-65 (Region 1). Minidoka Proj. L. N. McClellan, c/o owner, ch. engr.

Indiana—Warren Co. Rural Electric Membership Corp., Williamsport, 28 mi. rural distr. lines, sys. imprvs., Warren Co. **$205,000.**

Ia., Orange City—City, City Hall, power plant adn., generating equipment, switchboard, piping, etc. $70,000.

Kansas—Butler Rural Electric Co-operative, El Dorado, 187.75 mi. rural distr. lines, sys. imprvs., Butler, Harvey, Marion and Sedgwick Counties. **$258,000,** Frank Horton & Co., Lamar, engrs.

La., Belle Chasse—Officer in Charge of Constr., Bldg. 16 Naval Station, New Orleans, generator house and transformer vault, 16x16 ft., 9½ ft. high, incl. earthwork, creosoted wood piles, rein.-con. concrete unit work, metal doors, installation motor generator set. Plans deposit $10.

Maine—Kingman Electric Co., Kingman, 25 mi. rural distr. lines, 14 mi. 44 kv transmission line and sys. imprvs., Penobscot Co., **$210,000.**

Mass., Wakefield—Town, Municipal Electric Dpt., Town Hall, brick, steel, concrete electric power plant, North Ave. $250,000. Edw. M. Bridge, 131 State St., Boston, archt.

Mich., Detroit—State Hy. Dpt., Lansing, constr. and relocate of city lighting and power facilities altering water sys. on John C. Lodge Expressway from Brainard to Perry Sts., at Grand River Ave., U1 82-127, C12 (U1-404 (18), Part 2 **$130,000.** Plans deposit $3.

Missouri—Howell-Oregon Electric Cooperative, West Plains, 753 mi. rural distr. lines, sys. imprvs., Howell Co. **$1,500,000.**

Mo., Kennett—City, c/o J. W. Karsten, mayor, and Ben Cash, chn. Bd. P. Wks., Kennett, power plant imprvs., incl. diesel engine generator.

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., Spec. 2904, furnishing, del. f.o.b. cars shipping point or f.o.b. cars Havre, 1 control and relay board, with access doors, Havre substation, Fort Peck Proj., L. N. McClellan, c/o owner, ch. engr.

Nebraska—Bureau Reclamation, Dpt. Interior, Casper, Wyo., construct Alliance-Chadron 115 kilovolt transmission line, Missouri River Basin Proj. Transmission Div., Spec. 2901.

N. Y., Astoria—Consolidated Edison Co., 4 Irving Pl., New York, Zone 3, electric substation alterations, adn.

North Dakota—Electric Co-operative, Bismarck, 334 mi. rural distr. lines, Burleigh Co. **$440,000.** Ulteig Eng. Corp., 1114½ Front St., Fargo, consult. engrs.

Oklahoma—Southwestern Power Ad-

min., Dpt. Interior, Air Force Plant 3, c/o James V. Alfriend, Jr., actg. admin., Gore, transmission lines, Sect. 1, 154 kv H-frame for 24 mi. Fort Gibson Dam to near Gore, Sect. 2, 6 mi. 154 kv. H-frame line from Tenkiller Ferry Dam to northwest of Gore, $175,000.

South Carolina—Santee Electric Co-operative, Inc., Kingstree, 167 mi. rural distr. lines, Williamsburg Co. Plans deposit $25. McCall-Thomas Eng. Co. Inc., 112 Church St., Orangeburg, engr.

South Dakota—Bone Homme-Yankton Electric Assn., Tabor, rural distr. lines, sys. imprv., etc., Bon-Homme and Yankton Counties, **$775,000.** Buell & Winter, Insurance Exchange Bldg., Sioux City, Ia., consult. engrs.

Tex., Mineral Wells—Nazareth Hospital, Mineral Wells, brick, steel, concrete power house, laundry plant, mechanical garage, heating sys. $75,000. A. B. Withers, American Fidelity Bldg., Fort Worth, archt.

Washington—Bonneville Power Admin., Box 3537, Portland 8, Ore., control house and oil house at Olympia Substation, Inv. 4980. Plans deposit $25. L. C. Stewart, c/o owner, engr.

Low Bidders & Contracts Awarded

Calif., Muroc—U. S. Eng., 751 S. Figueroa St., Los Angeles, Jan. 24, test structures and appurtenances at Rocket Engine Test Station, Muroc Air Force Base, Eng 04-243-50-10, from Vinnell Co., Inc., 1145 Westminster Ave., Alhambra, **$984,963.**

Montana—Bureau Reclamation, Dpt. Interior, Bldg. 1A, Denver Federal Center, Denver, Colo., Schedules 1, 3 and 5, one 30,000 kva. auto-transformer with three 115,000 volt and three 12,470 volt lightning arresters, and one 6,500 kva. shunt reactor with spare parts and one 75 kva. transformer for Havre substation, to Pennsylvania Transformer Co., 803 Ridge Ave., Pittsburgh, Pa., **$89,583,** f.o.b. Havre. Bids 12/20, awarded 1/26.

Oklahoma—U. S. Eng., P. O. Box 61, Tulsa, three 11,600 to 14,500 single phase transformers, for Tenkiller Dam, CIV-ENG-68, to General Electric Co., Natl. Bank of Tulsa, Tulsa, **$124,380.** Est. $150,000. Bids 1/10, awarded 1/24.

Wash., Seattle—City, County-City Bldg., one 4, six 70,000 kva. transformers for Ross powerhouse Newhalem, to General Electric Co., River Rd., Schenectady, N. Y., **$747,000.** E. R. Hoffman, city light supt.

Wisconsin—Wisconsin Electric Power Co., 231 W. Michigan St., Zone 3, power and transmission line in towns of Granville and Milwaukee, Owner builds, **$150,000.** Fred A. Luber, Jr., c/o owner, engr.

Wyoming—Bureau Reclamation, Dpt. Interior, Cody, constr. Boysen-Thermopolis 115 kilovolt transmission line, Transmission Division, Missouri River Basin Proj., near Thermopolis, Spec. 2856, to Reither Constr. Co., Atkin, Minn., **$154,940.** Est. $169,525. Bids 1/4, awarded 1/24.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Tinley Park—State Div. Architecture & Engineering, Springfield, plans by C. Herrick Hammond, 53 W. Jackson St., Chicago, Zone 4, Illinois State Mental Hospital approx. 350 acres between Harlem Ave. 80 Ave. and 183 St. and Chicago Rock Island and Pacific R.R., near here, **$20,000,000.** Skidmore Owings & Merrill, 100 W. Monroe St., Chicago, Zone 3, consult. engrs.

N. Y., New York—Mt. Sinai Hospital, 5 Ave. and 100 St., hospital and laboratory, $7,000,000. Kahn & Jacobs, 2 Park Ave., archts. York & Sawyer, 101 Park Ave., consult. archts. Fred M. Severud, 415 Lexington Ave., engr.

Low Bidders & Contracts Awarded

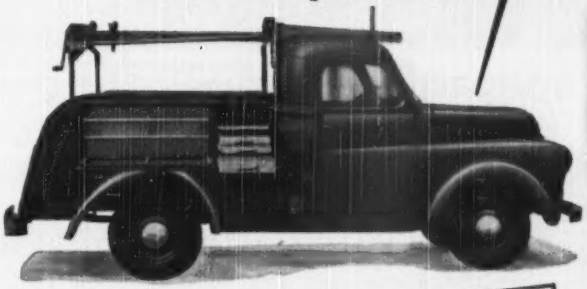
Conn., West Haven—U. S. Eng., Bldg. 21, U. S. Naval Drydock, South Boston, Mass., veterans hospital on 63 acre site between W. Spring St. on South Terrace Ave., on north and exten. along Campbell Ave., Serial No. Eng. 16-016-50-55, for Veterans Admin. Vermont Ave. between H & I Sts. N. W., Wash., 25, D. C., to Merritt-Chapman & Scott Corp., 17 Battery Pl., New York, N. Y., **$12,845,000.**

it's NEW!

YORK-HOOVER

model 4978

Public Utility BODY



* **Practical** . . . because all material and tools for light duty work are conveniently located.

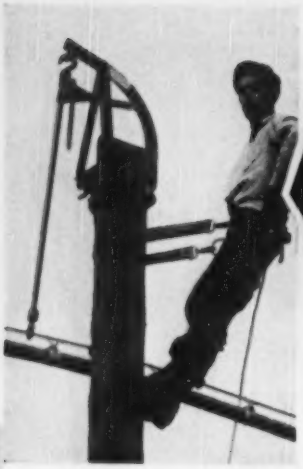
* **Flexible** . . . because standard and optional equipment are available to accomplish your specific job quickly and economically.

* **Efficient** . . . because all material and tool arrangements are in logical sequence and available for daily inventory.

Get the facts on the Model 4978 Body designed for installation on a standard ½ ton chassis. Write for Bulletin No. 927 today!

YORK-HOOVER

YORK BODY DIVISION CORPORATION PENNA



HIRE ONE MAN

and get a crew

with a **COFFING SAFETY-PULL HOIST**

One man with a Safety-Pull Ratchet Lever Hoist does the lifting, pulling, holding work of many — in shop or field. Even the smallest Safety-Pull, weighing only 14 lb., delivers a 1500-lb. vertical or horizontal pull — is ready to go to work wherever hooked. Laying conduit, raising heavy transformers, stretching guys—these are but a few of the jobs it handles easily, safely.

All Safety-Pulls are tested at 100 percent overload. Dual ratchet and pawl construction cannot slip—holds securely in any position. Choice of nine sizes with capacities up to 30,000 lb. Send for Bulletin E2SP.

Quik-Lift Electric Hoists • Hoist-Alls • Mighty-Midget Pullers • Spur-Geared Hoists • Differential Chain Hoists • Load Binders • I-Beam Trolleys

COFFING HOIST COMPANY
Danville, Illinois

TUG-O-WHEEL AERIAL CABLE BLOCKS

For safe and speedy installation of all types of aerial cables. Job proven by many years of reliable service. It has been adapted as standard cable placing equipment by telephone and power industry.

BLOCK TYPE "A"
For factory lashed power cable

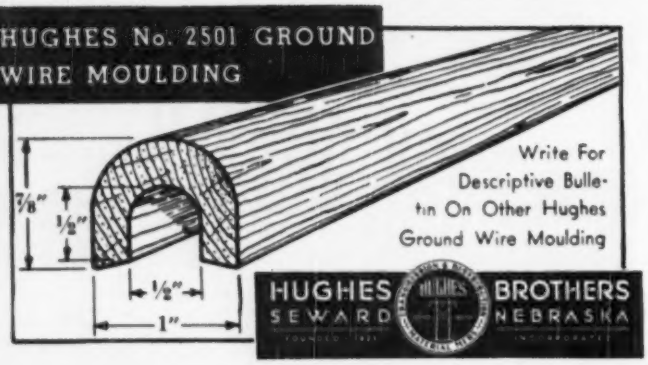
BLOCK TYPE "B"
For field lashed power cable

BLOCK TYPE "C"
For all sizes of telephone cable

Full data and specifications covering our complete line of cable placing equipment is available to all outside Plant Construction Supervisors, write or call

TUG-O-WHEEL PRODUCTS CO., BALLSTON SPA, N. Y.

HUGHES No. 2501 GROUND WIRE MOULDING



Write For Descriptive Bulletin On Other Hughes Ground Wire Moulding

HUGHES BROTHERS
SEWARD NEBRASKA

TECHNICAL LITERATURE

Standards—*Style Manual for American Standards* serves as a guide to bring about greater uniformity in presentation of technical data, particularly in those standards that have been given approval as "American Standards". Sections include suggestions for outline form and numbering, abbreviations for technical terms, rules for tables and illustrations, and general format with illustrations. Single copies are priced at $1, with smaller prices for quantity orders, from American Standards Association, 70 E. 45th St, New York 17, N. Y.

Floodlights—*Standards for Floodlight Layouts for Sports Areas* contains information about the kind and amount of illumination required for particular sports and classes of play. It is also intended to facilitate determination of the number and type of floodlights needed, and the location, height, and number of poles required. Publication FLI-1949 is obtainable for 75¢ from the National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Lead Paints—*Red Lead Paints for Marine Exposures* is a collection of formulas for corrosion inhibitive paints for metal surfaces exposed to sea water or marine atmospheres. It is Technical Letter No. 4 published by Lead Industries Association, 420 Lexington Ave, New York 17, N. Y.

Gears — Horsepower ratings, service factors, and features and accessories are among the specific standards contained in *Standards for Helical Reduction Gears for use with Steam Turbines*. Publication No. TU1-1949 costs 70¢ and can be had from National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Circuit Reclosers—*Proposed Standard for Automatic Circuit Reclosers for A-C Distribution Systems* applies to single or multiple ac automatic circuit reclosers rated from 1,500 to 15,000 v. This bulletin is available free of charge from the American Institute of Electrical Engineers, 33 W. 39th St, New York 18, N. Y.

Cable—A data book, *High Ampere AVC Cable*, carries specification tables, technical considerations of installation, capacity tables at various ambients, graphs for cable and conduit sizes and voltage drop for conductors with asbestos varnished cambric insulation. The 24-page publication is issued by Rockbestos Products Corp, New Haven 4, Conn.

Turbine Equipment — Definitions were compiled to furnish a common language for development of future standards in *Definitions for Marine-Propulsion Steam Turbine Electric Equipment (A-C)*. Diagrams illustrate turbine-generator arrangements and the general arrangement of propulsion equipment for turbine-electric drives. Publication MP3-1949 is obtainable for $1.25 from National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Building Wire—Subject matter of *Standards for Rubber Insulated Building Wire and Cable, 0-5,000 Volts*, covers dimensions, insulation, covering and testing of Types R, RH, RW, and RU. Forty-page publication RV2-1949, priced at $1.25, is available from National Electrical Manufacturers Association, 155 E. 44th St, New York 17, N. Y.

Watthour Meters—In celebration of its 50th anniversary, Sangamo Electric Co, Springfield, Ill., has published *Yardsticks for Power*. This small book traces the evolution of the watthour and demand meters (dc and ac)) to keep abreast of the accuracy and quantity requirements of the growing utility industry.

For Beautiful

Well Lighted STREETS

KERRIGAN STANDARDS

More than meet the Tests—

Write for

Your FREE copy now!

(on your letterhead, please).

Kerrigan Weldforged Lighting Standards are designed and engineered to conform to I.E.S. Street Lighting Codes, and meet the highest engineering standards for highway and street lighting. Whatever special lighting problems you may have, KERRIGAN can help you solve them. Check the Kerrigan specification list below to see what Kerrigan Weldforged Standards offer you, then write for our Lighting Standards booklet AIA 31F for detailed specifications and catalog information.

- √ 20, 25, 30 foot shafts to conform to I.E.S. recommendations; 4, 6, 8, 10, 12 and 15 foot mast arms to conform to I.E.S. recommendations.
- √ Continuous Tapered Octagon shafts from open hearth steel.
- √ Heavy Steel construction for maximum strength.
- √ Detachable mast arms, brackets, and transformer bases for easy installation and maintenance.
- √ Ornamental scroll braces for beauty and strength.
- √ Mechanically primed at the factory with red oxide, inside and out, for longer life. Finish coat can be easily applied after standards are in place.
- √ Special designs to meet ANY and ALL Special Requirements.

Consult the

KERRIGAN ENGINEERING DEPT.

concerning your street lighting problems

— Write —

KERRIGAN IRON WORKS, Inc.

General Sales Office:

274 MADISON AVENUE, N. Y. C.

Runway light wiring and other signal and landing light wiring at scores of progressive airports all over the nation is protected against moisture, oil, acids, etc., by "Scotch" No. 33 Electrical Tape.

How plastic tape helps make night landings safer

EMERGENCY TOWER FEEDER at the Houston, Texas Municipal Airport being insulated with "SCOTCH" No. 33 Electrical Tape. Plastic backing of tape is abrasion-resistant, withstands moisture, won't crack, chip or peel. Wiring recently weathered a 90-mile-an-hour hurricane with no damage.

FIELD LIGHT WIRING splices at the Houston Airport are dependably protected with "SCOTCH" No. 33 Electrical Tape. This is only one of the many insulating problems that can be solved with "SCOTCH" Electrical Tape. Write Dept. EW-250 for complete information, today. There will be no obligation.

Made in U. S. A. by **MINNESOTA MINING & MFG. CO.,** St. Paul 6, Minnesota

also makers of other "SCOTCH" Brand Pressure-Sensitive Tapes, "SCOTCH" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Abrasives, "3M" Adhesives.

General Export: DUREX ABRASIVES CORP., *New Rochelle, N. Y.*
In Canada: CANADIAN DUREX ABRASIVES LTD., *Brantford, Ontario*

To Help Good Workmen Make PERMANENT CONNECTIONS

These Sherman Splicing Sleeves give your workmen the finest of material with which to make strong, permanent, corrosion-free joints of highest conductivity.

A highly dependable line of sleeves, widely used throughout the electric utility trade. Each sleeve stamped for easy identification. Carefully packed.

Write for catalog illustrating the full Sherman line.

H. B. Sherman Mfg. Co.
Battle Creek, Mich.

Check Our Low Prices on
Sherman
SPLICING SLEEVES

wet process porcelain
ENGINEERED BY
GENERAL CERAMICS

A DEPENDABLE SUPPLY — General Ceramics offers a reliable supply of uniformly high quality wet process porcelain electrical insulators. Competent engineering cooperation is always available to help work out your designs.

Available in Wet Process Porcelain or Steatite, Metallized if Needed

Use General Ceramics Wet Process Steatite for extra mechanical strength. Can be tapped without metal inserts. Also obtainable metallized to specification. ESTIMATES WITHOUT OBLIGATION.

General CERAMICS and STEATITE CORP.
KEASBEY • NEW JERSEY

Makers of Steatite Insulators, Zircon Porcelain, Low-Loss Insulators, Light Duty Refractories, Chemical Stoneware

Know electricity as experts know it—
and get an expert's pay

EVERYWHERE the Croft Library is acknowledged as the standard—the leader in practical electrical education. It's a complete Home-Study Course, capable of equipping any ambitious man for success in the electrical field. The books are capable of solving quickly and easily all problems which rise up to puzzle you in the day's work. They are accurate — thorough—practical.

The Library's 2,906 pages give you facts drawn from actual electrical work as practiced by experts. Not in a lifetime could you gain by experience alone the knowledge that has been brought together by Terrell Croft in these books. And yet by spending a little time using them each day you can obtain in a short time a working knowledge of the entire field of modern electrical practice.

The Croft Library of
PRACTICAL ELECTRICITY
7 Volumes, 2906 pages, 1948 illus.

THE Croft Library is a complete electrical educator. Founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. Jammed from cover to cover with the kind of hardheaded facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 50,000 highly paid electrical workers and engineers.

Everything you need to know about: . . .

- armatures and commutators.
- transformers and circuits.
- switchboards and distribution systems.
- electrical machinery of every type.
- illumination in its every phase.
- the most improved methods of lighting.
- lamps and lamp effects.
- how to do a complete job, from planning it, to completion.

• NO MONEY DOWN—EASY PAYMENTS
10 DAYS' FREE EXAMINATION

Fill in and mail the coupon below and we will send you the entire set of seven volumes for 10 days' examination on approval. We take all the risk—you assume no obligation. If you decide to keep the books, send $3.50 in ten days and the balance at the rate of $4.00 a month.

McGraw-Hill Book Co., Inc., 330 W. 42nd St., NYC 18
Send me for 10 days' examination on approval the Croft Library of Practical Electricity, 7 vols. If satisfactory I will send you $3.50 in ten days and $4.00 monthly until the price of $19.50 is paid. If not wanted, I will return the books postpaid. We pay mailing costs if you send first payment with this coupon. Same return privilege.

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position W-2-13-50

This offer applies to U. S. only.

BOOK REVIEWS

Radio-frequency Heating Equipment. By L. L. Langton. Published by Pitman Publishing Corp, New York. 196 pages, illustrated. Price $3.75.

Radio-frequency, to this British author, means any frequency higher than 10 kc, and he explores the dielectrics, the thermionic generators, the dielectric work circuits and valves involved in the art. Other chapters deal with the requisite power supplies and the applications of dielectric heating and induction heating (which is called eddy-current heating). An appendix gives the British triodes available for the purpose and a compilation of plastic and dielectric properties.

Engineers' Dictionary—Spanish-English and English-Spanish. By L. A. Robb. Published by John Wiley & Sons, New York 16. 664 pages. Price $12.50.

Originally almost entirely composed of civil engineers' terms, this second edition has been enlarged to include electrical and mechanical words and phrases. As a result there is hardly a column in the English section which does not carry one or several electrical terms (not always, however, labeled as such). There are some 30,000 terms in each language and all of them are technical with special emphasis on such compound expressions as "chain winding," a point too seldom recognized in attempts at technical translative dictionaries.

Vacuum Equipment and Techniques. By A. Guthrie and R. K. Wakerling. Published by McGraw-Hill Book Co, New York 18. 264 pages, illustrated. Price $2.50.

One more of the National Nuclear Energy Series, this instalment deals with the laboratory developments which undoubtedly became the basis for the thermal diffusion process at Oak Ridge. It approaches vacuum theory on an electrical circuit foundation, treats thermal transpiration, diffusion pumps, vacuum gauges and leak detectors. A valuable appendix gives the formulas for vacuum technology and data about gases, pump oils and vacuum seal materials.

Transformer Principles and Practice. By J. B. Gibbs. Published by McGraw-Hill Book Co, Inc, New York 18. 236 pages, illustrated. Price $3.50.

Engineers familiar with the 1937 edition will know that it is a qualitative rather than quantitative-for-design treatment of transformers (power and instrument). The kindred reactors have been added in this edition along with the new designs and characteristics of transformers. Extensive citations from ASA and NEMA make the book both useful and timely.

Matrix Analysis of Electric Networks. By P. Le Corbeiller. Published by Harvard University Press (Cambridge, Mass.) and John Wiley & Sons, Inc (New York, 16). 112 pages, illustrated. Price $3.00.

Here is elucidation of the admittedly abstruse tensor analysis of Gabriel Kron which he applied not only to rotating machinery but to stationary networks. The present author explains the matrix procedure so that it can become intelligible and usable by electrical engineers as well as by the mathematical physicists. Professor Corbeiller's interpretation follows an evolution which is logically sequential whether (he is not cocksure) it truly represents Kron's technique.

Specify

G&W POTHEADS

RECOGNIZED STANDARD FOR RELIABLE CABLE TERMINATIONS SINCE 1905.

Interchangeable unit parts permit use of your preferred special features at minimum extra cost and time for shipment.

G&W ELECTRIC SPECIALTY CO.
7786 Dante Ave. Chicago 19, Ill.
Representatives in principal cities

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

Residential Load Building

(*Continued from page 92*)

the various utility areas.

We must not forget the youngest member of our appliance family—television. Twenty-four companies of the survey group reported nearly 1,262,000 sets presently installed or an average of about 53,000 sets per company. But only 4 were selling television sets and only 3 servicing them. Evaluating this load at about 16 kwhr per month per set, indicates attractive revenue ahead.

Concluding the survey questionnaire was a request to list several of the more pressing problems in load building. Reported here were bottled gas competition, high wiring and plumbing costs, dealer cooperation, radiant heating, and dealer salesmen.

This brief summary of survey replies indicates that while there is a growing appreciation of the need for aggressive load building, not enough has yet been done to meet that need in terms of organized effort in the industry and by the individual utility. Population growth and increased income since 1940 have greatly enlarged the market for electrical goods and services, but the average power company sales department is undermanned and is not taking full advantage of the load building potentialities that are open to it.

•

Today's Lightning Knowledge

(*Continued from page 79*)

Trouble due to lightning striking secondary buses or transformer secondaries is not as common as trouble due to lightning striking primary circuits because secondary buses are usually overbuilt with primary and are shielded, and because there is not normally sufficient voltage on the secondary to maintain the arc established by lightning discharges. In other words, commonly encountered secondary insulation expressed in inches per kv is quite high. Until fairly recently it was not common practice to provide lightning protection for transformer secondaries. Transformers are presently available equipped with spill-gaps for secondary lightning protection and are receiving wide use. Field data are not available on transformer performance with and without this protection.

Utilities Have Specified SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing Boom Mobile Cranes for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 3 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.

WINCHES: Capstans, Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.

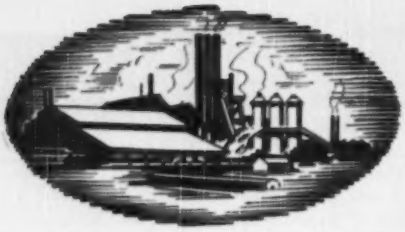
TOWERS: 2 or 3 section type and Pantagraph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS. for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic sl-de legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:
No. 79—*KRANE KAR* No. 70—*Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
½, 2, AND 10 TON CAPACITIES
KRANE KAR
SILENT HOIST & CRANE CO.
262 63rd ST. BROOKLYN 20, NEW YORK



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- ★ Since 1900 we have increased our supply of machine power 4½ times.
- ★ Since 1900 we have more than doubled the output each of us produces for every hour we work.
- ★ Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- ★ Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

A PUBLIC SERVICE PROJECT · THE ADVERTISING COUNCIL

Published in the public interest by:

McGraw-Hill Publications

100% Visibility When You Employ

Binkley Guy Guards

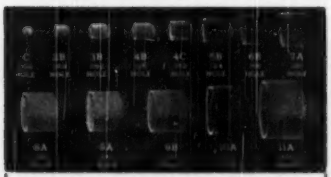
Yes, 100% visibility insures the utmost in protection and appearance to your guy lines and poles. Maximum flexibility and ease of attachment are paramount with BINKLEY Guy Guards.

Two Types—Half Round and Tapered Round 7' and 8' lengths

WE INVITE YOUR INQUIRIES —NEW LOW PRICES

Binkley

Address Dept. EW **MANUFACTURING CO. WARRENTON, MO.**

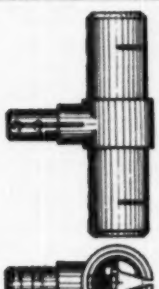


STAR INSULATING BEADS

Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality heads at low cost. Quickly applied. Flexible Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.

51 Muirhead Ave. Trenton, N. J.



MEMCO (SINCE 1918)

SUBSTATIONS — OUTDOOR & INDOOR SWITCHES — INTERNAL PRESSURE TYPE CONNECTORS — FITTINGS —

MEMCO ENGR. & MFG. CO., INC.
37-48 61 STREET WOODSIDE, L. I., N. Y.

LETTERS TO THE EDITOR

Dry Chemical Extinguishers

To The Editor of ELECTRICAL WORLD:

Page 117 of your November 19, 1949 issue carried a story on dry chemical fire extinguishing equipment with which we'd like to differ . . . for the integrity of the produce we make and sell, we feel the need for straightening out several of the published statements.

Paragraph (1) contained a reference to the newness of dry chemical extinguishers in the electrical field . . . dry chemical extinguishers have been used to protect electrical hazards for some time. . . . Dugas dry chemical extinguishers protected electrical equipment at the Chicago World's Fair in 1933-34. Ansul subsequently bought Dugas Engineering Corp.

Paragraph (2): Extinguishment by dry chemical extinguishers is a result of a combination of four or five different actions. To our knowledge, no relative values have ever been assigned to these actions. . . . Our calculations have proved that heat absorption is not the principal extinguishing action, however.

Paragraph (4): Ansul has advertised . . . the non-abrasive properties of our dry chemical. Published test reports from the Factory Mutual Laboratories have been the basis for this advertising program.

Paragraph (5): Our experience . . . contradicts these exaggerated claims for extinguishing effectiveness. No dry chemical hand extinguisher will extinguish a 400 sq ft gasoline spill fire—let alone do it in 20 sec. . . .

Illustration: Careful study . . . will show that the operator is considerably closer than 15 ft away from the transformer fire. The most effective range of the dry chemical extinguisher illustrated is about 8 to 10 ft.

Naturally, we are deeply concerned with letting the facts speak for themselves on dry chemical [but] . . . occasionally . . . a story appears that can damage our own good product and the good products of . . . other companies. That's when we feel compelled to speak up and set the record straight.

Knowing the high editorial standards of ELECTRICAL WORLD, we felt that its editors would like to know what's what in this dramatic field of dry chemical fire fighting.

J. R. West
Customer Relations

Ansul Chemical Company
Marinette, Wisconsin

PREMAX

Cut Costs of Pole Identification

Fight mounting costs of identification by using Premax Metal Letters and Figures. They cost less to apply than old-fashioned stenciling—and these letters and Figures will ALWAYS remain visible, generally exceeding the life of the pole.

Write for samples and prices.

PREMAX PRODUCTS
DIVISION CHISHOLM-RYDER CO. INC.
5048 HIGHLAND AVE., NIAGARA FALLS, N. Y.

UNEQUALLED

. . . FOR TRUE SPLICING ECONOMY

...users who KNOW buy only the BEST

Ask for them by name...

OKONITE and MANSON tapes

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
84 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway — Kansas City 2, Missouri

HUGH L. COOPER & CO., INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro - electric power plants.

350 Fifth Avenue — New York 1, N. Y.

ROBERT A. CUMMINGS, JR. AND ASSOCIATES

Aerial Mapping Surveys

Aerial Photography, Mosaics, Strip Maps
Topographic Maps, Profiles.
Structural & Mechanical Design

239 4th Ave. — Pittsburgh 22, Pa.

DAY & ZIMMERMANN, INC.

Engineers

Design - Construction - Management
Investigations and Reports

PHILADELPHIA
NEW YORK — Packard Building — CHICAGO

Doble Engineering Company

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation. Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 30 N. Wacker Dr. — Chicago, Ill.

Ebasco Services Incorporated

Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street — New York

ELECTRICAL TESTING LABORATORIES INC.

Specializing in
TECHNICAL SERVICES
to those intent upon good quality

2 East End Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Design—Surveys—Appraisals
Construction & Maintenance
Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. — Binghamton, N. Y.

The Real Value

of placing your unusual problem in the hands of a competent consultant is that it eliminates the elements of chance and uncertainty from the problem and provides real facts upon which to base decisions.

FORD, BACON & DAVIS

Engineers

DESIGN . CONSTRUCTION
VALUATIONS . REPORTS

New York . Philadelphia . Chicago . Los Angeles

GILBERT ASSOCIATES, Inc.

Engineers and Consultants

DESIGN AND SUPERVISION OF STEAM, HYDRO, WATER SUPPLY, SEWAGE DISPOSAL AND DIESEL PLANTS
Reports . Rates . Labor Relations . Safety
Purchasing . Costs . Laboratory

New York — Reading, Pa. — Washington
Houston — Philadelphia

HARZA ENGINEERING CO.

Consulting Engineers

L. F. HARZA
E. MONTFORD FUCIK CALVIN V. DAVIS
Hydro-Electric Power Projects
Transmission Lines, System Management, Dams, Foundations, Harbor Structures, Soil Mechanics

400 W. Madison St. — Chicago 6, Ill.

HOOSIER ENGINEERING COMPANY

Erecting Engineers

Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

N. A. LOUGEE & COMPANY

(Successors to J. H. Manning & Company)

REPORTS—INVESTIGATIONS—VALUATIONS
BUSINESS AND ECONOMIC STUDIES

120 Broadway — New York

LUCAS & LUICK

Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

ARTHUR L. MULLERGREN

Engineering-Management

Public—Utilities—Natural Gas

Kansas City, Mo.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing . .
Specialists in Financing
Accounting and Other Operations

231 So. La Salle St. — Chicago 4

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD

Bill Frequency Analyzer

100 Sixth Ave. WOrth 4-8326 New York 13, N. Y.

SANDERSON & PORTER

Engineers and Constructors

New York — Chicago
San Francisco — Los Angeles

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

F. W. SCHEIDENHELM

Consulting Engineer

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

50 Church Street. — New York 7, N. Y.

F. A. TUCKER, INC.

Contractors—Engineers

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office—23½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.

Construction and Maintenance

Transmission-Distribution
Electric and Telephone Lines
Consultants

501 York Road — Jenkintown, Pa.
1240 Oliver Bldg. — Pittsburgh, Pa.

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT — BUSINESS
EQUIPMENT — USED OR RESALE

OPPORTUNITIES

UNDISPLAYED RATE

(Not available for equipment advertising)

$1.20 a line, minimum 4 lines.
To figure advance payment count 5 average words as a line.

Individual Employment Wanted—Advertising rate is ½ the above rate payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as one line.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED, SEVERAL engineering graduates, under 35, by large industrial fire prevention organization maintained by national insurance group, for field work involving periodic inspections and special consulting service. Permanent. P-1995, Electrical World.

WANTED, SALES Engineer. Requirements (1) Electrical Engineering Degree; (2) First hand knowledge of electric line construction materials; (3) Experience with, or preferably employment within, electric public utilities; (4) A sales-minded, hard-driving extrovert; (5) Willingness to travel. Permanent position as direct-from-factory contact man, on nation-wide basis, between a mid-west manufacturer of line construction materials and its customers, electrical public utilities. Write P-2073, Electrical World.

ELECTRICAL FOREMAN for installation and maintenance all types electrical equipment, lighting, heating, and power, large Copper Company, Chile, South America. Single man preferred. 2-year contract. Transportation both ways and salary while traveling paid by company. In reply give complete details. P-2190, Electrical World.

ASSISTANT OFFICE Engineer for compilation of data, reports, equipment records and requisitions for purchase of material covering electrical equipment entire property of large Copper Company in Chile, South America. Single man preferred. 2-year contract. Transportation both ways and salary while traveling paid by Company. In reply give complete details. P-2191, Electrical World.

CONSULTING ORGANIZATION supervising operations of large number of electric utility systems requires active electrical engineering graduate, with General Operating Superintendent type of experience, capable of full responsibility electrical system maintenance, operation and betterment. Good opportunity for right man. Some foreign travel. P-2144, Electrical World.

YOUNG OR Middle aged electro-metallurgist experienced in electric furnaces for the alloy and carbide industry. Replies confidential. P-2210, Electrical World.

MANAGER FOR Expanding Utah Power system. Existing facilities include hydro, Diesel, Steam, and transmission being purchased by cooperative federation and substantially enlarged. The man we want must prove ability to handle a $7,000,000 business; engineering, utility or cooperative background desirable. Apply to Southwest Utah Power Federation, Inc., Cedar City, Utah.

(Continued on page 160)

MAKES GOOD USE . . .

. . . of "Pre-Filed" product data

Mr. C. L. Osterberger, General Sales Manager of the Louisiana Power and Light Company of New Orleans, Louisiana is often called upon for advice in the selection of electrical machinery, equipment and supplies.

He needs factual data to enable him to compare the relative advantages of various manufacturers' products and to decide which is best for his clients' needs. Such factual product information is always at his finger tips, for Mr. Osterberger is a regular user of the McGRAW-HILL PRE-FILED ELECTRICAL CATALOGS.

Here's what Mr. Osterberger has to say: *"I use ELECTRICAL CATALOGS regularly in connection with recommendations to customers, dealers, architects etc."*

If PRE-FILED ELECTRICAL CATALOGS is not available for buying reference at your plant, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N. Y.

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street, New York, 18, N. Y.

THE LINEMAN'S HANDBOOK

1. That transmission line fact you want is in this handy guide giving principles, data, methods and cautions on all aspects of the lineman's work. Describes all the materials of line construction; poles, conductors, hardware, tools, electrical apparatus, etc. Information on construction, testing and maintenance shows how to meet problems with right choice of materials and methods. **By E. Kurtz, U. of Iowa. 2nd Edit., 602 pages, $5.00**

ELECTRICAL ESTIMATING

2. In this manual is all the information you need to estimate the cost of any electrical construction job . . . quickly and accurately. Covers everything from the selection and training of estimators, and the proper use of estimating tools . . . to the cost of preliminary estimates, and the preparation of final bid sheets. Contains scores of sample estimates of actual construction costs. **By R. Ashley, Research Eng'r. 327 pages, $6.50**

ELECTRIC DISTRIBUTION FUNDAMENTALS

3. This second edition gives sound solutions to problems of electric distribution . . . essential data on design and construction, operation and service, methods and equipment and mechanics and materials. Discusses how the distribution system works —how it is planned, designed and constructed—how service and operating routine is handled. Covers voltage drop, wire size calculations, transformer connections, etc. **By F. Sanford, Copper Wire Eng'r. Assoc. 283 pages, $3.50**

HANDBOOK OF RIGGING

4. Condensed into this new book are all the tips, methods and techniques essential to more effective rigging practices in industrial and construction operation. Deals with everyday maintenance operations—with the transportation and handling of heavy machinery — with the erection and demolition of smaller size structures. Covers everything from ropes, hoisting chains and hooks, to slings and ladders. **By W. E. Rosenagel, Safety Eng'r. 321 pages, $4.75**

SEE THESE BOOKS 10 DAYS FREE

McGraw-Hill Book Co., Inc.
330 W. 42nd St., New York 18

Send me book(s) corresponding to numbers encircled below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep, plus a few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.

1 2 3 4

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position ..... W 2-13-50

This offer applies to U. S. only.

DESIGN ENGINEER VACANCIES

Progressive and Growing Midwest Electrical Manufacturing Organization. One of the Leaders in Outdoor Electric Power Distribution and Transmission Equipment. Has Openings for:

(1) Designers for High Voltage Air Break Switches and Related Equipment.

(2) Electrical and Mechanical Engineers for Development and Design of Distribution Protective Equipment.

(3) Designers Experienced in Stampings, Screw Machine Parts, and Other Mass Production Items Where Cost Is a Vital Consideration.

All Positions Are Permanent. Only Experienced Men Will Be Considered.

P-2040, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

MECHANICAL OR ELECTRICAL ENGINEER

Mechanical or Electrical Engineer about age forty-five needed to supervise Utility Company's Steam Generating Stations having a total capacity of approximately 200,000 kilowatts and located in Middle Atlantic area. Applicant must have technical education and broad generating experience, with ability to supervise, engineer and operate modern Stations.

Submit complete resume of personal background, education, experience and salary expected.

P-2217, Electrical World
330 W. 42nd St., New York 18, N. Y.

Wanted
ELECTRICAL OR MECHANICAL ENGINEERING GRADUATE

For work in new High Pressure Steam Plant in Mid-South area. Three or more years experience desired. Excellent working conditions, employee benefit program and opportunity for advancement. Give age, experience and educational qualifications.

P-2247, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

REGISTERED ENGINEER

Large electric transmission and generating Cooperative needs electrical engineer to head it's Engineering Department. Permanent position for right man.

Write
902 Amicable Building, Waco, Texas

WANTED

POWER SALES ENGINEER

for sales development work with industry and the farm. Engineering graduate, age 30 - 35, sales experience desirable. Good opportunity with small progressive electric utility in Ohio. Write, giving full information and salary expected.

SW-1943, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

SCHOOL

Electrical Meter Engineering
"The Profession With a Future"

Meter Department demands are bringing good opportunities to meter experts.
HOME STUDY COURSE
Practical up-to-date home study covers all phases of Meter Work
Write Today for Free Booklet
Fort Wayne Correspondence School
Dept. 128, 201 Dime Bk. Bldg. Fort Wayne 2, Ind.

SELLING OPPORTUNITIES OFFERED

WANTED ELECTRICAL Engineer to travel and assist in sales of transformers and distribution equipment. Preferably with some utility experience. State briefly qualifications, experience and age in reply to: SW-2023, Electrical World.

SWITCH, BX, EMT, and Thermostat Cable Lines wanted by well established manufacturers' representative for Illinois, Indiana, Michigan, Wisconsin, Minnesota, Dakotas and Montana. RA-1996, Electrical World.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

WANTED: POSITION as meter tester or meter repair. Several years experience in testing. PW-1778, Electrical World.

ELECTRICAL ENGINEER, reg., 33, eleven years power system operation, control and protection, calculating board exper., desires employment with private utility. PW-1898, Electrical World.

CONSTRUCTION SUPERINTENDENT Substations, Transmission and Distribution Lines and underground systems. Good estimating and organizing ability. Employed, prefer change domestic or foreign. References and interview. PW-1913, Electrical World.

GRADUATE ELECTRICAL Engineer, 28, married, 15 years hydropower, utility, industrial engineering, planning, administration in America and Europe desires responsible position with utility, large mining or industrial enterprise in Northwest, Canada or Alaska. Replies: PW-1941, Electrical World.

POSITION AS Electrical Sales engineering trainee (power equipment) wanted by young electrical design-draftsman with degree and 3½ yrs. experience in the industrial, power plant, and refinery fields. PW-1975, Electrical World.

MAINTENANCE ENGINEER of Wide experience in Electrical and Mechanical of power plants, plant equipment, general repairing, installing, construction, layout and designing. PW-2236, Electrical World.

STAFF ASSISTANT for Planning and Policing. Well trained as assistant to president or treasurer where integrity, varied experience, mature judgment and ability to meet people are required. Twenty-five years' experience in expense reduction, methods, accounting and sales. Excellent references. PW-2169, Electrical World.

ELECTRICAL ENGINEER Graduate. Age 50. With over 20 years exp. in layout, designing, power plants, industrial plants, switch-boards, automatic controls, installation, testing, power lighting and distribution. PW-2237, Electrical World.

DeLAVAL INSULATING OIL PURIFIER

Model 45 Unimatic
Capacity 100 gallons per hour
Practically new. $375.00

WEBER MACHINERY CO.
1801 East 21 Street
Cleveland 14, Ohio

NEW SUBWAY SWITCHES

19—New 400 Ampere, 7.5 KVA, 3 Way, Type 55, Serial #10723, Railway Industrial Engineering Switches 9 Sleeves on bottom for 1 conductor cable.
$125.00 Each
Industrial Electric & Supply Co., Inc.
37-1681 Memphis, Tenn. P. O. Box 1398

FOR SALE
7000 DEMAND REGISTERS

General Electric Types M-14 & M-20; Westinghouse Types DR & RW; Sangamo Type HCB. All 120 V., 60 cycle, 30-minute. Large assortment of ratios.

E. N. GOODMAN
12 East 23rd Street New York 10, N. Y.
Tel. ALgonquin 4-2954

FOR SALE—TRANSFORMERS
Line Hardware and Secondary Power Equip.

3—667 KVA G.E. Rebuilt Transformers, out door, single phase, 60 cycle, 33000 V. primary—440 V. secondary, type H, form HD. Also line hardware, secondary power equipment, 3 phase Buss runs, etc. New and never used.

COMFORT SPRING CORPORATION
Baltimore 31, Maryland

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. 2905) will be received by Bureau of Reclamation, Denver, Colorado, March 2, 1950, and then publicly opened for furnishing three 115-kv, 1,200-ampere, 3,500,000-kva, outdoor power circuit breakers; and six 115-kv, 600-ampere, 3-pole air switches for the Flatiron switchyard, Colorado-Big Thompson Project, Colorado. Delivery is desired within 150 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner.
(100)

Don't Forget the BOX NUMBER

When answering the classified advertisements in this magazine. It's our only means of identifying the advertisement you are answering.

FOR SALE

EARTH BORING MACHINES

New and Used with Equipment As Listed

USED

5—Earth Boring Machines, Highway Model HD, mounted and ready for work.
5—2½ Ton 6x6 Trucks
5—Highway Double Drum Winches with two way Power Take Off installed
5—Truck Bodies fully designed for Line Construction work.
5—Booms, T Type or Tri-Pod.

Price for Each Unit . . $5,750

SLIGHTLY USED

1—Model H Jaques Demonstrator mounted on All-Wheel-Drive truck. Pole Setter, Extra Augers and Equipped, ready for work.

A Tremendous Savings at . . $7,800

NEW

4—Model K Jaques Machines. Priced to sell quick. These machines are available as result of building own machines, the NEW "STERLING" Model "A". Ask for a demonstration! Check with our owners as to responsibility and type service we offer!

WYOMING VALLEY EQUIPMENT COMPANY

1089 Wyoming Avenue
Forty Fort (Wilkes-Barre) Penna.

DIESEL POWER

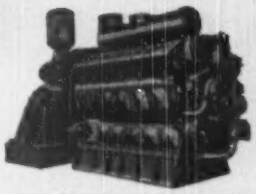
FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	32F16	2000	300	375	Enterprise	D6C-6	450	450
1420	Fairbanks Morse	38D8⅛	1800	720	330	Superior	SUA	396	514
1250	General Motors	16-278A	1000	720	312	General Motors	6-268A	450	1200
937.5	General Motors	12-567	1000	720	312	Clark	MD-4	375	327
625	Alco	6-12¼x12T	750	600	187	Ingersoll Rand	8	225	514
625	Baldwin	VO-6	810	450	125	General Motors	2-268A	150	1200
400	Buckeye	80	480	600	75	General Motors	6043C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS

KW	Make	Desc.
4000	G.E.	Auto extraction—250 lbs. I.S.P. 35 lbs. ex.—2300 v. 3 ph. 60 cy.
750	G.E.	Condensing—250 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
300	G.E.	Non-condensing 150/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.
400	Wlse.	Non-condensing 125/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
5140	Wlse.	[illegible]	2400/4150	600
4000	G.E.	TSC	2400/4150	900
3000	Wlse.	[illegible]	2400/4800	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1800	G.E.	600	125/250	2300/4150
1600	G.E.	900	275	2300/4400
1500	G.E.	600	600	2300/4150
1250	G.E.	600	575	4150
1000	Wlse.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2500	Wlse.	OISC	1	66000x11000
2500	Al. Ch.	OISC	3	13200x2300
2500	Pack.	AT	3	13800x2300
1250	G.E.	HVDDJ	1	6900x550
1000	Phlts.	OISC	3	13200x2300
600	Al. Ch.	OISC	3	2300/4150x220/440
333	Phlts.	OISC	1	26400x2000
167	G.E.	Its	1	2400x240-480

FREQUENCY CHANGERS

2000	KW	G.E.	25/60 cy. 2300/2300 v.
500	KW	A. C.	25/60cy. 11000/2300v.

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.

52 Church St., New York 7, N. Y.

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes. One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

FOR SALE

1 675 HP. Worthington Air Injection Diesel Engine.
1 480 HP. Busch-Sulzer Air Injection Diesel Engine.
Including all auxiliaries, motor, generators, etc.
Can be seen in operation any time.

Contact Mayor or City Clerk
Independence, Iowa

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave., Chicago 14, Ill.

MOTORS, GENERATORS, TRANSFORMERS
1 – 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO
ROCHESTER 1, N. Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

SLIP RING MOTORS

1—2500 HP G.E. MT 257 RPM 6600V
1— 500 HP G.E. MT 720 RPM 2200 V 4150

SYNCHRONOUS CONDENSER

1—2500 KVA Wlse 720 RPM 2200 V with D.C. Exc.

MOTOR GENERATORS

1—1000 KW Wlse 275 V 720 RPM 4150 Volt
1—1000 KW G.E. 600 V 514 RPM 2200/4000 V
1— 500 KW G.E. 275 V 900 RPM 4150 Volt
2— 150 KW G.E. 125/250 V 1200 RPM 4150 Volt

TRANSFORMERS

1—5000 KVA Amer. 3 Ph. 27,000V. 2300V.
3—3500 KVA G.E. 3 Ph. 27,000V. 2302V.
1—1500 KVA G.E. 3 Ph. 4150 V 2300 V Pyranol
1—1000 KVA G.E. 3 Ph. 4150 V 2400 V
1—1000 G.E. 3 Ph. 4150, 2 Ph. 2400 V
2— 750 KVA G.E. 3 Ph. 4150 V 460 V Pyranol
3— 400 KVA G.E. 6900 2300 V Sec.
3— 100 KVA G.E. 4150-240/480 V Pyranol
3— 75 KVA G.E. 2400-240/480 V
3— 75 KVA Wlse 2300 230/115

Complete Line of A.C. and D.C. Motors and Generators

Now . . . Electrical World's Survey of

MODERN ELECTRIC SYSTEMS

- their development
- their potential

HERE IS the sweeping panorama of the evolution of energy generation, distribution and utilization. This is the story of the progress of the great American electric power systems, both private and public, and the social and economic forces underlying their growth.

Designed for easy reading, this book brings you in compact form the unique record of the development of hydro- and turbo - electric power plants — of techniques for the construction, operation and maintenance of the far-flung systems —of public regulation over companies, their rates and their profits— of the spasmodic movements for federal and municipal ownership of electric utilities—and of the rise of industry organizations.

Discusses—

- Power systems
- Power stations
- Station generation
- Transmission
- General system techniques
- Distribution
- Maintenance and metering
- Use of electricity
- Organization and regulation
- Industry organization

Just published

THE ELECTRIC POWER INDUSTRY

Past, Present and Future

Compiled by the Editors of Electrical World

386 pages • 8½ x 11 • Over 200 charts, graphs, diagrams, tables, photographs • $3.50

THIS SURVEY of one of the world's greatest industries is a permanent bound edition of the 75th Anniversary Number of *Electrical World*. Specialists contributed their knowledge and research to make this volume a unique log of industry achievement.

Every major phase of electric power development is covered—generating equipment, transmission lines, protective relaying, substation design, power metering, rural electrification, holding companies, state regulation, N.E.M.A., Edison Electric Institute, National Electrical Wholesalers Association, etc., etc.

DISCOUNTS

Ideally suited for training of junior executives, sales staffs, and for use by others in the utilities field. When used for these purposes, books are available at special rates. In requesting information tell us how many copies you will need. Write to:

SPECIAL SERVICE DEPARTMENT,
Attn: Wm. E. Foley,
McGraw-Hill Book Co.,
330 W. 42nd St.,
N.Y.C. 18

SEE THIS BOOK 10 DAYS—FREE

McGraw-Hill Book Company, Inc.
330 W. 42nd St., New York 18

Send me The Electric Power Industry for 10 days' examination on approval. In 10 days I will remit $3.50, plus a few cents for delivery, or return book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

Name .....
Address .....
City ..... Zone ..... State .....
Company .....
Position W-12-17-49

This offer applies to U. S. only.

Advertising in This Issue

Advertising Council Inc., The 156
Allen-Bradley Co. 19, 20
Allis-Chalmers Mfg. Co. 9, 24, 25, 46, 47
American Brass Co. 145
American Creosoting Co. 34
American Steel & Wire Co. 52, 53
Anaconda Wire & Cable Co. 113
Ansonia Electrical Div., The Noma Electric Corp. 21
Appleton Electric Co. 119

Babcock & Wilcox Co. 130, 131
Baltimore & Ohio Railroad 12
Bartlett Tree Experts 149
Bauer & Black Div. of Kendall Co. 122
Baxter & Co., J. H. 144
Bell Telephone Laboratories 54
Bethlehem Steel Co. 50
Binkley Mfg. Co. 157
Brown Co. 134
Buell Engineering Co. 148
Bussmann Mfg. Co. 102, 103

Chase-Shawmut Co., The 11
Cobra Wood Treatment Corp. 140
Coffing Hoist Co. 152
Continental-Diamond Fibre Co. .. 17
Control Corp 142
Copperweld Steel Co. 14
Corning Glass Works 35
Crescent Tool Co. 45
Crosley Div., Avco Mfg. Corp. .. 123

Delta-Star Electric Co. .. Third Cover
Dow Chemical Co. 115
Directory of Engineers 158
Dravo Corp. 57

Eisler Engineering Co., Inc. 112
Electric Controller & Mfg. Co., The 44
Electric Storage Battery Co., The 37
Elliott Co. 38, 39
Engineers, Directory of 158
Everstick Anchor Co. 114

Four Wheel Drive Auto Co. 36

G&W Electric Specialty Co. 155
General Ceramics & Steatite Corp. 154
General Electric Co.
Apparatus Dept. .. 93, 95, 97, 98, 99
Appliance & Merchandise Dept. 42, 43
Construction Materials Dept. .. 32
Graybar Electric Co. 5
Gulf Oil Corp. 26
Guth Co., The Edwin F. 120, 121

Harper Co., The H. M. 16
Hazard Insulated Wire Works .. 4, 157
Hevi Duty Electric Co. 132
Hoskins Mfg. Co. 6
Hotpoint, Inc. 117
Hubbard & Co. 125
Hughes Bros. 152

Indiana Steel & Wire Co. 155
Irvington Varnish & Insulator Co. 40
I-T-E Circuit Breaker Co. 106, 107

Jenkins Bros. 18

Keasbey & Mattison Co. 48
Kerrigan Iron Works, Inc 153
Klein & Sons, Mathias 147
Kuhlman Electric Co. 141

Lapp Insulator Co., Inc. 23
Larkin Lectro Products Corp. 135
Line Material Co. 27, 28, 29, 30, 31
Littleford Bros., Inc. 147

McGraw-Hill Book Co., Inc. 154, 159, 162
McGraw-Hill Pre-Filed Electrical Catalogs 159
Memco Eng. & Mfg. Co., Inc. 157
Minnesota Mining & Mfg. Co. 153
Mitchell Mfg. Co. 41
Moloney Electric Co. 105
Mosinee Paper Mills Co. 128
Murray Mfg. Co., D. J. 150
Murray Mfg. Corp. .... Second Cover

National Electric Products Corp. 60
National Telephone Supply Co., The 133

Ohio Brass Co. 111
Okonite Co., The 4, 157

Pacific Electric Mfg. Corp. 55
Page Fence Assoc. 150
Page Steel & Wire Div. American Chain & Cable 149
Pennsylvania Transformer Co. 33
Penn-Union Electric Corp. 7
Philadelphia Gear Works, Inc. 129
Porcelain Products, Inc. 49
Prat Daniel Corp. 139
Premax Products Div. Chisholm-Ryder Co., Inc. 157

RLM Standards Institute 22
Railway & Industrial Engineering Co. 13
Revere Copper & Brass, Inc. 101
Rockbestos Products Corp. 143
Ryerson & Son, Inc., Joseph T. .. 137

Searchlight Section 159, 160, 161
Sherman Mfg. Co., H. B. 154
Silent Hoist & Crane Co. 155
Simplex Wire & Cable Co. 8
Socony-Vacuum Oil Co., Inc. 15
Sorgel Electric Co. 138
Southern States Equipment Corp. 10
Square D Co. 51
Standard Oil Co. (Indiana) .... Fourth Cover
Star Porcelain Co. 157
Stone & Webster Engineering Corp. 109

Tug-O-Wheel Products Co. 152

United States Steel Corp. 52, 53

Wagner Electric Corp. 56
Westinghouse Electric Corp. 127

York-Hoover Corp. 151

■

PROFESSIONAL SERVICES 158

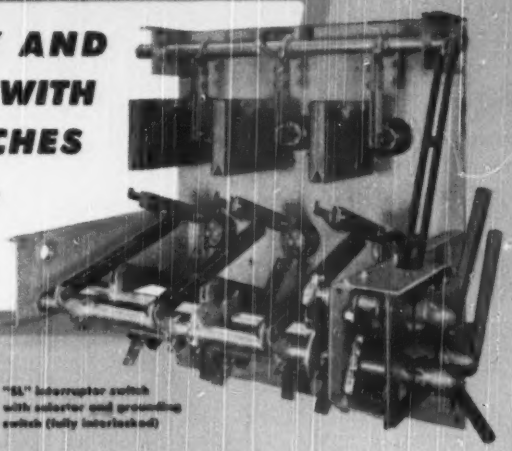
■

SEARCHLIGHT SECTION
(Classified Advertising)

EMPLOYMENT
Positions Vacant 159, 160
Selling Opportunities Offered 160
Positions Wanted 160
Selling Opportunities Wanted 160
Employment Service 160
EDUCATIONAL
Schools 160
EQUIPMENT
(Used or Surplus New)
For Sale 160, 161
WANTED
Equipment 160

GREATER FLEXIBILITY AND LOW COST PROTECTION WITH "SL" INTERRUPTER SWITCHES

Not just an interrupter—not just a disconnect—but a combination that breaks loads safely—and when equipped with power fuses you get full system protection.



"SL" interrupter switch with isolator and grounding switch (fully interlocked)

When specifications call for opening of circuits under moderate load you will find Delta-Star type "SL" interrupter switches will meet the requirements perfectly. Used with power fuses, they provide an economical means of fault protection. Standard or special arrangements are all designed, manufactured and tested to operate as an integral part of your system equipment.

Units are available in voltage ratings of 5, 7.5 and 15-kv. with interrupting capacities of 400, 200 and 100 amperes respectively. Continuous capacity of switches may be as desired since the main switch is independent of the interrupter. Furnished with or without metal housings in single, two or three pole units for mounting on transformers, walls or structures.

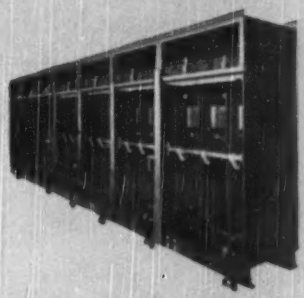
Load interruption is accomplished by momentarily shunting the full load current through a by-pass circuit. Here the arc is extinguished by rapidly elongating it within a confining chute. Danger of external arcing or contact burning is eliminated.

For complete information consult our nearest representative or ask for Publication 4612

THERE IS AN "SL" INTERRUPTER SWITCH FOR EVERY APPLICATION

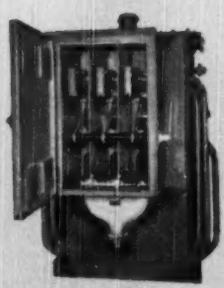
Heavy gage steel cabinets for both indoor and outdoor service

Large doors provide easy access to equipment for inspection and maintenance. Door handles on all indoor metal enclosed units are of the key type. Padlock clips are provided for locking handle in open or closed position.



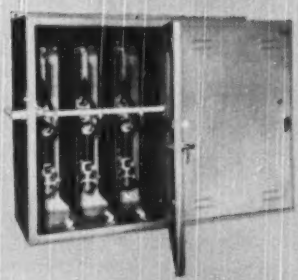
Long bank of three-pole interrupters

Whether you require this type of installation or a single pole unit, "SL" interrupters meet every requirement. Provision for mounting key interlocks is standard on all equipment. Interlocks can also be furnished where sequence operation is desired.



"SL" interrupter switch mounted directly on transformer

Terminators can be arranged on top or bottom of interrupter housing and furnished in several different arrangements for single feeder, looping circuits, etc. Units are easily operated by direct handle or hook-stick as preferred.



Interrupter in combination with power fuses for fault protection

Each operating handle is equipped with a latch to prevent blade opening under short circuit currents. The latch is released by means of a trigger located on the operating handle and can be padlocked to prevent unauthorized operation.

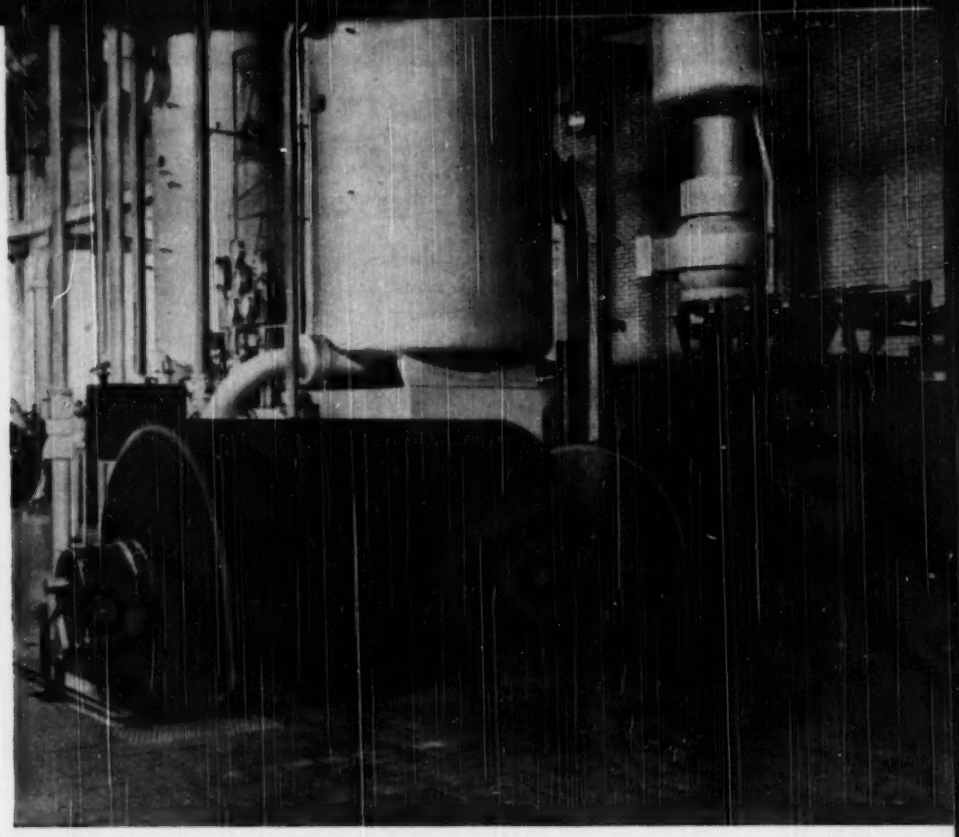
DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY: 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE: 100 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES:

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Cincinnati, O.
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
Indianapolis, Ind.
Jacksonville, Fla.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
Newark, N. J.
Norfolk, Va.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
Roanoke, Va.
St. Louis, Mo.
San Francisco, Cal.
Seattle, Wash.
Tampa, Fla.
Washington, D. C.
Huntsville, Ala.

CANADIAN ASSOCIATE:
Canadian Line Materials Limited
Toronto, Ont., Canada



Used 18 years, oil goes right back on the job

● In 18 years of operation, the original fill of NONPAREIL Turbine Oil was never removed from this 2500-KW turbine at the University of Michigan power house. Neutralization numbers always stayed below 0.07 mg. KOH/gm. Tests of oil samples showed no deterioration of the lubricant.

Recently, the turbine was shut down for inspection and general overhaul. Operators drained NONPAREIL from the unit and took a close look at the oil system. *They found no oil deposits, no evidence of rust, and not a sign of corrosion.* The oil itself was in excellent condition and after centrifuging it was returned to the turbine for continued use.

You, too, can obtain such lubrication advantages. By switching to NONPAREIL Turbine Oil, you can eliminate oil acidity troubles and oil system maintenance once and for all. These benefits are not only indicated by the experience of others but are backed by the written guarantee you receive that NONPAREIL will last as long as the turbine and that its acidity will stay below 0.15 mg. KOH/gm.

A Standard Oil lubrication specialist will be glad to supply you with actual case histories of utility operations on which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. To arrange for his visit, write: Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.

NONPAREIL
Turbine Oil

"WILL OUTLAST YOUR TURBINE"

STANDARD OIL COMPANY (INDIANA) STANDARD